A. P. Brooks

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THE ALLAHABAD FARMER

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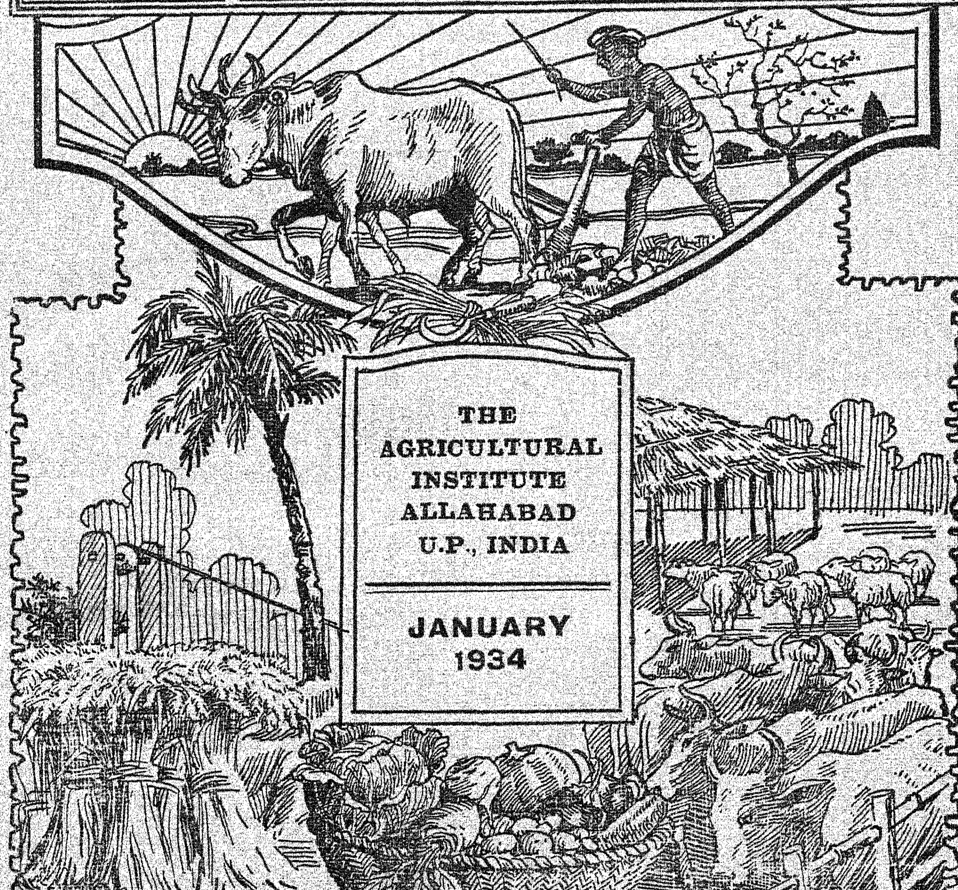
OF

Agriculture and Rural Life

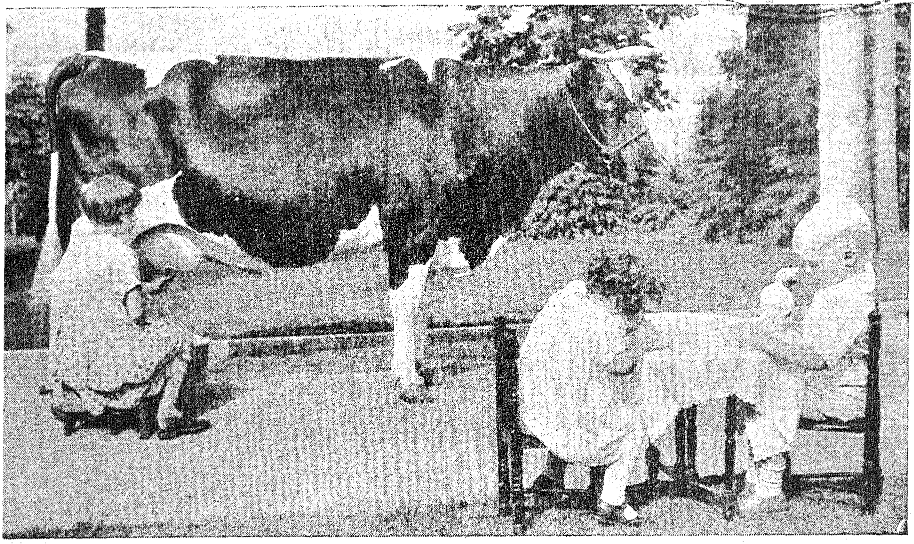


THE
AGRICULTURAL
INSTITUTE
ALLAHABAD
U.P., INDIA

JANUARY
1934

The New Year brings the date of the new constitution for India nearer. A large expansion of the electorate and a large transference of power are prominent features of this constitution. The questions that will then be put by the 90 per cent of India's population who live in the villages will be: "What has the State done for agriculture? What have the Legislative Councils done for the farmer and his live stock? What have the intelligentzia done to improve the lot of the villagers?" I trust that the New Year will usher in a resolve on the part of the three parties concerned to enter on a policy of vigorous preparation for answering these questions satisfactorily.

—SIR T. VIJAYARAGHAVACHARYA,
Vice-Chairman, Imperial Council of Agricultural Research.



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The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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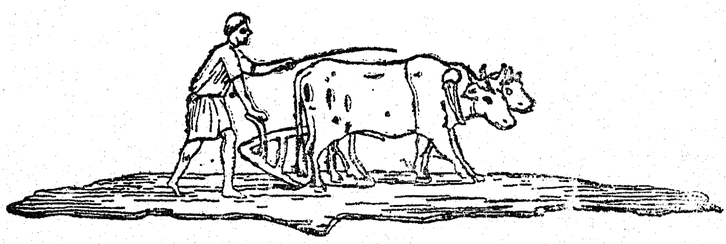

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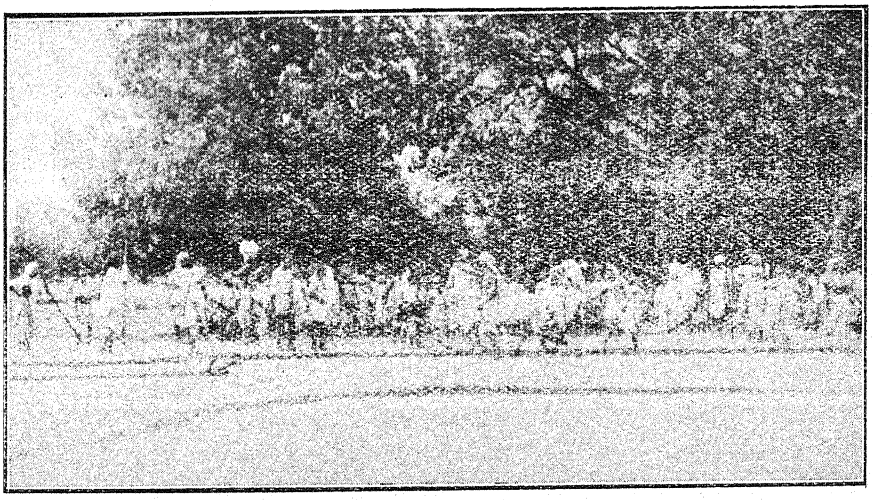


PLOUGHING DEMONSTRATION—SERAI AQIL

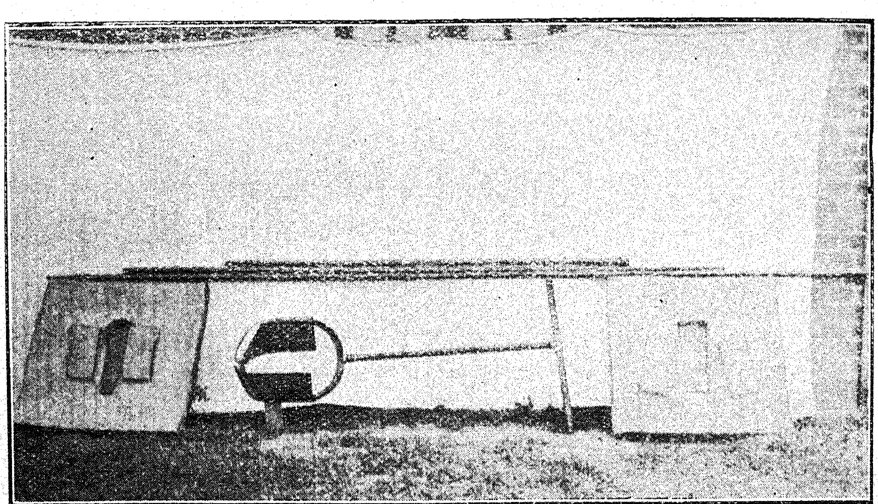
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or schoolchildren and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE

ALLAHABAD FARMER

VOL. VIII] JANUARY, 1934 [No. 1

Editorial, 1934

"The Near Year brings the date of the new constitution for India nearer. A large expansion of the electorate and a large transference of power are prominent features of this constitution. The questions that will then be put by the 90 per cent of India's population who live in villages will be: 'What has the State done for agriculture? What have the Legislative Councils done for the farmer and his live stock? What has the intelligentzia done to improve the lot of the villagers?' I trust that the New Year will usher in a resolve on the part of the three parties concerned to enter on a policy of vigorous preparation for answering these questions satisfactorily."—SIR T. VIJAYARAGHAVACHARYA, *Vice-Chairman, Imperial Council of Agricultural Research.*

* * * *

Farmers' Fair Announcement, March 7-10th.

The 4th Annual Farmers' Fair will be held at the Allahabad Agricultural Institute commencing on the 7th March and continuing until the 10th evening.

This fair has been of increasing interest and value to all those either directly or indirectly interested in agriculture and dairying and rural life programmes.

A cordial invitation is hereby extended to all our readers to visit the fair. If you will require accommodation while in Allahabad, you should communicate at an early date with Mr. Mason Vaugh, chairman, Farmers' Fair Committee.

Visit Allahabad and see the Fair!

A Criticism of the U.P. Civil Veterinary Department.

While the following few lines may seem to be critical of the activities of the Civil Veterinary Department, we are not unmindful of the good work that has been done, and the difficulties under which the work has been carried out. The fact remains that, in spite of modern methods available to combat disease and the knowledge available with regard to preventive medicine, heavy mortality of cattle continues to be an outstanding feature of the official monthly reports of the Director, Civil Veterinary Department.

The following figures will serve to illustrate the point:—

1933		*Seizures*	*Deaths*	*Percentage Mortality*
September ..	Rinderpest ..	5,033	2,665	52·9
	Foot-and-Mouth ..	5,082	581	11·4
	Hæmorrhagic Septicæmia	1,172	585	49·9
October ..	Rinderpest ..	2,922	1,693	57·9
	Foot-and-Mouth ..	2,624	442	16·8

In addition to the outbreaks reported, and the mortality connected therewith, it is quite probable that many outbreaks have not been reported so that the total figure of mortality would be much larger than noted above.

It is to be hoped that in the year 1934 and the years to come Government will provide the necessary means whereby cattle mortality will be reduced. Landowners and organizations interested in improving the economic welfare of the peasant should co-operate with the Civil Veterinary Department with a view to popularizing the method of protecting cattle from rinderpest by the immunization process.

A statement of the services available by the Civil Veterinary Department—and all departments for that matter—should be drawn up, and given the widest publicity, so that people may be well informed, and may act intelligently in the utilization of the services that are available.

AVERAGE COMPOSITION OF MILK AND MILK PRODUCTS*

Product	Water	Protein (Nx6·37)	Fat	Lactose, etc. (By Difference)	Mineral Matter (Ash)	Fuel Value Per Pound
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Calories
Whole Milk ..	87·1	3·4	3·9	4 9	0·7	310
Cream— Single ..	72·5	2·9	20·0	4·0	·6	942
Double ..	54 4	2·2	40·0	3 0	·4	1,727
Skim Milk ..	90·5	3·5	·2	5·0	·8	162
Whey	93·0	1·0	·3	5 1	·6	123
Butter Milk ..	90·7	3·5	·5	4·6	·7	167
Evaporated Milk, Unsweetened ..	73·7	7·0	7·9	9·9	1·5	629
Condensed Milk, Sweetened ..	27·0	8·1	8·4	54·8	1·7	1,484
Dried Whole Milk ..	3·5	25·8	26·7	38·0	6 0	2,248
Dried Skim Milk ..	3·5	35·6	1 0	52·0	7·9	1,630
Butter	15·5	0·6	81·0	·4	2·5	3,325
Cheese— American Cheddar	34·5	25·6	34 7	1·9	3·3	1,916
Swiss ..	34 0	28·6	31·3	1·9	4·2	1,831
Cottage (Skim Milk)	74·0	19 2	·8	4.3	1·7	459
Cream ..	42·7	14·5	39·9	1·0	1·9	1,910

*Compiled by Food Composition Section, Bureau of Home Economics, U.S.D.A.

Lord Kelvin once said to his students: "Gentlemen, when you are faced with a great difficulty, you may be on the verge of a great discovery."

"In Java each acre of land yields 50 tons of sugar-cane, with 12 per cent sugar, i.e., 6 tons of sugar per acre. In India one acre gives 13 tons of cane, with 8½ per cent sugar, i.e., 1 ton of sugar per acre. *There is no escape from the conclusion that cane cultivation must be improved in India.*"—*Statesman.*

EDUCATION THROUGH MARIONETTES*

By K. N. Gupta, M.A., Higher T.D., Government Normal School, Allahabad,

and

Dr. J. C. Manry, M.A., Ph.D., Christian College, Allahabad

[Note.—The authors will be glad to correspond with readers who are interested in making practical use of marionettes in teaching hygiene, economy, thrift, co-operation, and improved agriculture. They hope to publish reports of such experiments from time time.

Beginners will find the following volume a sufficient guide: "Dolls and Puppets," by Max Von Boehn. Translated by J. Nicoll, G. G. Harrap and Co, Ltd., London, 30s. A smaller and less expensive volume that will serve the purpose is: "Everybody's Theatre," by H. W. Whanslaw. Wells, Gardner, Darton, and Co., Ltd., London. 3s].

Intimate Relation of Handwork to Character.

Worthy citizenship through character development should be one of the primary aims of education. If this is granted, then we must for ever remember that character neither was, nor is, nor will be, formed by mere talking and reading, but always grows through the child's doing something purposive; that means, of course, purposive from the child's point of view. Hence the importance of handwork in the cause of *real education*.

Purposeful activity, both physical and mental, develops the understanding. Through such activity, accompanied with satisfaction, worthy ideals and truly social attitudes toward these ideals are established—ideals, when pursued consistently, from behaviour-patterns some of which are reduced to habits and skills. These behaviour-patterns and habits and skills, when highly integrated to conform to the standards accepted, result in strong, well-balanced personality—the ultimate goal of character education.

Through the legitimate use of handwork the well-established principle of activity can, in an effective manner, be brought into even our dullest, most monotonous, and lifeless schools. Soon they will no longer mark time: they will be galvanized into fresh life; they will be fitted to the child's harmonious development—physical, mental, and moral aspects of the child. Æsthetic education, roughly the education of the feeling-side of the human organism, without which any amount of attempts at character-building will be frustrated, can be inextricably interwoven with our existing physical and intellectual education through handwork, and mainly through the *pivotal* technique of Marionettes, Masks, and Shadow-plays.

*In the preparation of this article we have received much help from Rachet Gampert, Winifred H. Mills, Louise M. Dunn, and Waldo S. Lanchester, to all of whom we make grateful acknowledgments.—Authors.

Child Nature.

Children like pictures, particularly coloured pictures, in two dimensions—length and breadth. They like still more toys with a third dimension, depth, or thickness; and they like, most of all, those toys if they move about. Children are naturally, when unspoiled by repression, so active themselves that they sympathize most readily with that in the environment which is constantly on the move.

Moreover, children are generally very fond of wee things. Marionettes fulfil all these conditions. Therefore they suit child nature most if the puppets are made to do those things which are taken from the children's growing and ever-increasing accustomed environment. Besides these advantages, for us in India there is the additional fact that the tradition behind the marionette lies deep in the country; hence it is one of the most potent means of *real education*.

History and Form of Marionettes.

The roots of the family tree of the marionette are deep in the life of Ancient Egypt, India, Persia, China, Japan, and Java. Its great trunk springs from the soil of Greece and Rome; its branches spread over Europe and reach America.

Of all forms of the marionette the shadowgraph is the most convincing. The elaborate art created by the Shadow Theatre of Java, where it appears to have been raised to a fine pitch of delicacy and beauty, is of particular interest to educationists. The shadow graph theatre is in modern times frequently met in Europe and America.

Oriental Origin of Marionettes either in Egypt or India.

Excavations in Egypt have proved that marionettes were common in that strange land five thousand years and more ago. In India too such performances are very ancient, but now they are dying out.

The marionette has great antiquity. So ancient are puppets that it is impossible to trace their origin. It is quite possible that India, rather than Egypt, was their first home. The people of India believed that puppets lived with the gods long before they came down to this world. There is a story of Parvati, wife of the god Shiva, that tells of a puppet which she made that was so beautiful that she was afraid to let her husband see it so she carried it away secretly to the Malay Mountains. But Shiva suspected his wife and followed her. When Shiva saw the beauty of the puppet which she was trying to hide from him, he fell in love with it, and brought it to life.

Another story is told in India about a basket of wonderful wooden dolls that was given to a little princess. These dolls were made in such a way that, when the princess touched appropriate

small wooden pegs, one would fly through the air and return with a wreath of flowers; still another could dance, and one could even talk. When puppets were made to represent the gods, they were made of pure gold and birds trained to talk were placed in their mouths.

The fame of these Indian puppets reached Persia and Turkey, China and Burma, Siam and Java, in each of which countries the puppets were different, and different kinds of temples and theatres were made for them. Even the elephan's carved for them to ride upon were different in each country.

In India, China, and Japan the great rulers were greatly interested in puppets, and required their presence at court. We often hear of wonderful marionettes which were one of the most popular entertainments of the courtiers of Akbar the Great.

In Ancient Greece Archimedes, Socrates, and Plato are the names of three famous friends of marionettes which have come down to us. Archimedes, the greatest inventor of his time, liked puppets, it is said, because he could devise so many clever ways of making them move and appear human. Socrates enjoyed taking a puppet in his own hands, asking it clever questions, and then furnishing equally clever answers. These most unusual conversations would soon gather about him a crowd of Athenian men and women, who were greatly interested in his humour, irony, and whimsical paradoxes. The dialogue would probably go on and on until his scolding wife, Xantippe, appeared. Plato cared little for their mechanism as Socrates, his master, also probably did; but, like his great master, he was interested only when they were made to talk about the serious things of life, or when he saw them representing the gods and heroes in the beautiful scenes of the plays given on the small stages for them in one part of the great theatres.

Puppets after the Renaissance, following the decline of miracle-plays, became popular in Europe, and reached their height during the 17th, and the early part of the 18th, centuries. At first they dealt exclusively with stories from the Bible, and the field widened slowly. That the real and the fable were confused is proved by the riots that not infrequently occurred when harrowing subjects were presented.

As in almost all other European countries, the earliest English puppets were those which gave religious plays in the churches. From the churches they went out among the people, still giving plays founded on the Bible stories and the lives of the saints. These plays were combinations of shadowgraph and marionette and the English people called them "motions." English puppeteers were also very fond of going to the fairs.

Probably the most popular play in England in those days was one called, "The Old Creation of the World, with the Addition of Noah's Flood." The best scene showed "Noah and his family coming out of the ark with all the animals, two by two, and all the fowls of the air seen in prospect sitting upon trees; likewise, over the ark is the sun rising in a glorious manner; moreover, a multitude of angels in a double rank, the angels ringing bells...."

This play was given for fifty-two successive nights. Mr. Powell, the clever fellow who owned these puppets, once set up his theatre just outside the colonnades of Covent Garden, opposite the parish church of St. Paul. He began his plays at the sound of the church bells, and was successful in diverting so many from the church services that he was severely reproved by churchmen.

About 1642 all regular theatres were abolished in England, but marionette-theatres were not included in the prohibition. When news of this reached France and Italy, many showmen started at once for England. They knew for certain that they could gather pennies on the way from almost every pocket.

To-day the most beautiful English puppets are being made by Mr. William Simmonds, who, began his work with puppet-plays for village children. Mr. Simmonds manipulates his own puppets as he cleverly improvises songs, dances, and pantomimes.

Within the past two decades there has been a decided revival of marionettes, and great mechanical ingenuity has been expended in giving the tiny figures life-like activities. Such a life-like performance of the puppet-show has robbed one of the most ancient, but artificial, forms of entertainment of much of its antique flavour; but it gives boys and girls a distinct impression of the difference between the artificial and the real. This distinction was not always made in a long history of marionettes.

For over 30 years F. Alice Marzials, of Oxford, has developed marionette-theatres and puppets—both the "stringed" and "gloved"—varieties, written plays for them, and worked them; and his present efforts to simplify puppetry for the use of children are the outcome of a desire to provide them with an educational hobby of such absorbing interest that they will be willing to spend upon it some of the time they now devote to the cinema.

Those educationists who intend to utilize the cinema in the cause of education should carefully read what Mr. Marzials, out of his vast experience, says about the cinema:

"There can, I think, be no question that many of the films the children see are very bad for them, and that these pictures either give a wrong direction to childhood's all-important impulse towards imitation, as seen from time to time in our police-court news, or else, by their ever-increasing sensationalism, they induce a kind

of mental inertia which is greatly to be deplored." Some such cases are found in Cyril Burt's "The Young Delinquent."

So it is quite easy to understand why in Vienna and Geneva very strict laws have been passed against boys and girls below sixteen going to the general public cinemas. In these cities special arrangements have been made for such shows for school-going children to have educational significance.

Mr. Marzials further says: "Some years ago I saw a silent film called 'Nero' which was largely advertised as educational. The house was packed with children, although it was a hot summer afternoon, and I can still see with the eye of memory that horrible series of 'close-ups' of a clever, forceful actor's face registering every phase of gradation of lust and cruelty—a most unedifying spectacle masquerading under the guise of history.

"I could hardly sit through such performances, but all round me young people were thoroughly enjoying it; and I realized that, had I been brought up from childhood on this unnaturally stimulating mental food, I too, in all probability, would have become hardened to it, and ready, as they were, for the increasing length and intensity of the doses necessary to keep excitement from turning into weariness and satiety.

"No one will deny the value of films displaying the wonders of the world, the habits of bird and beast, the industries of many lands. But this form of education is an absorbing of knowledge only, and for children it should be counterbalanced by facilities for expression, for invention, for creation, more especially in the age of wonderfully perfect mechanism in which there is so great a tendency to let machinery do everything, even our thinking, for us. With some of my young friends who indulge in the cinema habit mental inertia has reached such a pitch that they cannot remember the details of films that interested them only a few hours before.

"It is to counteract this inertia by providing a delightful activity, making great demands upon the inventive and creative faculties, and one that is well within the scope of children of nine years old and upwards, that I offer a simplified form of puppetry, one of the oldest of the arts, and yet, unfortunately, one of the most difficult to describe. It is easy enough to give details and to state facts; but, to make those who have never seen it realize its fascination over puppeteer and audience alike—that is well-nigh impossible, though many gifted writers have tried their hands at it; and it is this fact that makes propaganda so difficult. Talk or write about it, and you raise little enthusiasm; demonstrate it, and at once you obtain a roomful of converts, as I have proved over and over again."

We have also here in India to convince people by doing, and not merely by talking and writing.

Bernard Shaw.

Mr. George Bernard Shaw, in "Back to Methuselah," has arraigned mankind through the mouth of the she-ancient for its incurable interest in playing with "rag dolls." That Mr. Shaw recognized traces of the same weakness in himself is confessed by his preparatory note to a book in which the rag doll of infancy is glorified and traced through all its manifestations and elaborations from the dawn of time to the present day.

Gordon Craig.

Mr. Gordon Craig is a great English artist who sees marionettes not as so much wood and cloth pulled about by a few strings at the whim of careless people, but rather as real creatures, human or more than human, quiet and dignified, like the gods of old. It has been his delight to give them again the great roles of literature. He too invited the greatest actors of Europe to come and learn from them.

Puppet-shows have, at various times in the history of the world, held enthralled the circle of the simplest peasant, and yet led playwrights like Shaw, producers like Gordo Craig, and great actresses like Eleonora Duse, to say or hint that in these mechanical dolls, with their strange, intense parody of human expression, gait, and gesture, lies the truest theatre for which, if a choice had to be made, might well be sacrificed the larger theatre with human actors.

Values of Marionettes.

Many readers will regard the preceding statement as extreme, if not absurd. Most people, however, will agree with Shaw that the wooden actors may be instructive object-lessons to our flesh-and-blood players. They are engaging toys, and much may be learned from them, because they are miniatures in size, intensely packed compendiums of expression and gestures, beatifully-carved figures, and handsome scenery and costumes.

Moreover, to make these little wooden or clay characters play and speak does not present any of the drawbacks such as developing vanity, the fondness for "showing off," and the like as children's theatrical performances do too often. In the puppet-show the children stand and act from behind the curtain.

Lanchester on the Values of Marionettes in Elementary Schools.

Mr. Waldo S. Lanchester, partner of the famous puppeteer, H. W. Whanslaw, writes in a recent letter from London: "There is certainly a great deal of simple handicraft in the making of puppets, wood-carving or modelling the heads, costume designs, scenic designs, and dramatic literature, either the old

legends rewritten for the puppets or modern plays, the chief thing being plenty of change in scene (and lighting if possible.) We are just getting the elementary schools here in one part of London interested; and, for the children, practically all the usual lessons can be turned towards the puppet stage, drawing, cutting out paper for decorative purposes, for lino-cut printing, all help towards the scenic effect. In dressing there is needlework and the research into history for the correct kind of dress; and, finally, in the performance the children can introduce the singing of folk-songs and music, as well as the training of speech before others."

History, Literature and Life At Once.

By marionettes we can teach history and literature and life at once in the most effective manner according to the Laws of Learning: "Every school should have its model theatre" for "Education is a preparation for life, not merely for livelihood; and any school activity that contributes to the amenities of existence and intercourse is a necessary and laudable part of the educational system."*

The Adult Education Committee London, (Report).

Again, in the report by the Adult Education Committee of the Board of Education (London), we find these weighty words on the subject: "Architecture, sculpture, and painting, music and diction, poetry and prose, gesture and dancing all are ready to find their place in the drama, and to combine in its production." Instead therefore of setting children to make articles of passing utility in the manual training class, why not get them to make, in either cardboard or wood, a durable model theatre for staging plays in the school—all with but little expense? We can imagine no more interesting, and, at the same time, profitable, lesson; for, apart from manual training, the utility of the model theatre will only be beginning as the work of "chips" is, so far, finishing.

By means of the model theatre we can teach handicrafts, literature, history, and dressmaking, and develop *originality* and a sense of the picturesque possibilities of the stage.

Czechoslovakia.

In Czechoslovakia the doll-theatre is an important means for the education not only of young people, but also of adults, especially parents. The doll-theatre is also an important means for the dissemination of knowledge regarding public hygiene, domestic science, and other such practical subjects. Much work has been done in this respect. Therefore many newspapers in Czechoslovakia have a regular column for the doll-theatre, and the column is never lacking in interest or variety.

The total number of marionette-theatres in Czechoslovakia is said to be in the neighbourhood of 3,500. The literature available

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* The Teaching of English in England

for these is very rich; there exist almost 1,500 original Czech plays, besides a great many translated from other languages, and there are several technical works on manipulation, properties, and scenery.

At the present time more than 150 educated persons, including a number with the highest academic degrees, are engaged exclusively in puppet-shows, travelling from town to town and village to village throughout Czechoslovakia. In this progressive republic the puppet-show has become one of the principal means of entertainment, instruction, and character-formation for schools of all grades, for families, and for adult educational societies. Where resources do not permit of a real theatre, these little people replace it. Rural populations in particular find in them a healthy and an artistic entertainment. Thus puppet-shows bring students, parents, and teachers into closer and more intimate touch with each other—an indispensable condition for making any reform really successful.

Well-known Czech artists such as Dr. Vesely and Dr. Podrecca have created models of characters as ingenious as they are artistic, and scenery in proportion to these miniature actors of a height of 18,25,50 centimetres. Dr. Driml has used these characters to teach the principles of hygiene, life insurance, and economy.

Austria.

In Vienna the artist Richard Teschner has created some modern marionettes. He has carved them most delicately from wood, and has shown great ingenuity in the way he has put his little figures together.

America.

In America there is a growing list of friends of the marionette: Tony Sarg, a charming artist who has taken his puppet-plays to the largest cities of America and delighted the people with his "Rip Van Winkle," "Rose and the King," and "Don Quixote." The manager of his marionettes, Mr. Mathew Searle, is also an artist of ingenuity and taste.

In Chicago the splendid work of Mr. and Mrs. Maurice Brown made new friends for the marionette. Mr. Perry Dilley introduced marionettes to the people of California. He produced a great number of interesting plays, and all of his puppets are exceptionally fine. Mr. William Duncan and Mr. Edward Mabley, creators of the "Tatterman Marionettes," have brought to the marionette stage unusual imagination and skill which is admirably shown in their "The Melon Thief," "The King of the Golden River," and "Pierre Patelin."

In California all the mysteries of running a puppet-show are being revealed to a class chosen from the Los Angeles public schools. In giving, for example, the thrilling drama, "Jack and the Bean Stalk," the strings were worked by youngsters under the

direction of efficient supervision. At the public presentation Jack climbed and the giant danced in rage at the dictates of little people behind the scenes who spiritedly ran the controlling apparatus. In the internationally famous elementary schools of Winnetka (Illinois), under the guidance of the City Superintendent of Schools, the children are likewise making great use of marionettes.

In Other Countries As Well. Marionette-shows are being revived and re-formed not only in England, Czechoslovakia, Austria, and America; other countries, such as Belgium, France, Germany, Switzerland, Italy, Japan, Romania, and Russia, each has a distinctive development to report within recent years.

India. Here in India, where financial limitations, for the time being, do not permit an educational theatre or cinema, and where even the "magic lantern" is too costly for the teeming millions of the rural population, these little people in the puppet-show should prove doubly welcome to all educationists of vision, that is to say, to all educationists worthy the name. The rural population would specially find in the puppets healthy and artistic entertainment, as well as instruction. Schools, both urban and rural, will be able to make the puppets themselves and conduct the plays. The costumes and scenery cost for a year far less than the trappings for a single "drama" as currently produced in many schools. The model theatre built by the pupils themselves would be permanent. It will be a source of great interest for lessons in manual work, art, needlework, and even in language, history, and geography. The marionette can be very interestingly, and therefore educatively, made a pivotal subject for several traditional school subjects; and the values of co-operative societies, of good seeds, of scientific and economical agricultural implements, of panchayats, and so on can be effectively taught.

By F. Alice Marzials, Oxford

Here I'm lying in my box—just bits of wood—
Stuff and leather, strung together, wondering whether
You will help me. Ah, you could if so you would!
Take me up and disentangle these my strings, now all a-jangle.
You must glove your hands with patience, and forget Time's scurrying roar.
There now—set me moving—thus, and let me
Ere your wireless comes to fret me,
Clothe myself with memory's garments from
Your rich and varied store.
Think of kings, and then my gesture
Will be royal as my vesture.
Think of villains, and you'll see me
Slouch and cringe from door to door.
Use me kindly, and then blindly
Will I do your utmost bidding, mirror forth
Your joy or pain.
By myself, just useless lumber,
Here I lie in stagnant slumber,
Hoping, heart-sick, for the day when man
Will use me once again.

EUROPE TO ALLAHABAD BY MOTOR-CAR

By Dr. Sam Higginbottom

A party of nine, with two cars, recently motored across Europe, Syria, Iraq, Persia, and Baluchistan to Allahabad. The journey occupied two and a half months. It was both educative and full of pleasure. We had very few unpleasant experiences. Everywhere we found officials and others in the fifteen countries through which we journeyed helpful, courteous, and considerate.

Comparing motoring in these other countries with motoring in India, one cannot help noticing certain things.

India has some excellent trunk roads, well marked, in some sections as good as any we travelled over. The roads through the villages and cities are generally good. It is easy to find one's way. This is a very great help.

Some of the roads of India are very dusty. My main objection to a dusty road is not that I do not appreciate the taste of the dust, or breathing the germ-laden mess, or that my eyes become full of it, or that my clothes are ruined by it: I object to a dusty road because in a motor age it is unsafe, and very dangerous.

On a dusty road, as one is driving, one sees an oncoming car, but can see nothing beyond it; as it passes one's own car, the cloud of dust is as impenetrable as a London fog. If another car is following the one just passed, or if a bullock-cart or pedestrian is just ahead, there is danger of a death-dealing accident. In fact, several lives have been sacrificed to dusty roads within the last few months. If one decides to stand still till the cloud of dust subsides, it does not ensure safety for an oncoming vehicle may crash into one.

When one compares driving in India with most of these other countries, one feels that India is the most nerve-wracking on the motor driver of any country we passed through. Driving in India, even on the open road, far from the cities, is not the same pleasure that it is in other countries. I think the reason for this arises from the varying ideas of the use of the road prevailing in the several countries. In most countries the idea seems to be that the road is for the use of travellers who are going somewhere, and to facilitate this the road must be kept clear, and certain rules of passing must be observed.

But our experience of the roads of India is that many have the idea that the roads are for the purpose of folding cattle, goats, and sheep, for sleeping upon, for storing building material, for spreading out grain to dry; that it is immaterial which side one travels on, that strings of bullock-carts completely monopolize the road, that many of the drivers are so sound asleep that a generous

use of the motor horn fails to arouse them; some of the drivers who are awake decide to draw to one side in order to let the motor pass. By actual count, about 50 per cent of the bullock-cart drivers take to one side of the road, and an equal number go to the other. The carts of which the drivers are asleep often remain neutral, and compel the motorist to thread his way first from one side of the road to the other. In dry weather this is not so bad, but in the rains, when the ground at the side of the road is soft, there is danger of the motor getting stuck. Again, if for any reason a halt is required by any cart or tonga, it is very seldom that the driver pulls up at the side of the road; he usually stops right in the middle of the road. There is a common habit of tonga and ekka-drivers in cities going a little over from the middle of the road towards the right-hand side and to stay there as long as possible, thus causing vehicles coming in the opposite direction to go off the road on to the patrie. Also in cities heavily laden ox-carts and hand-carts get the centre of the road, and hold it against all comers. They know that any quick-moving vehicle that risks an interview with them is likely to come off second best.

Again, in many towns and cities roads near the brick-kilns and railway goods-yards are apt to provide a race-course for a cart drawn by oxen and one drawn by buffaloes. Whenever this happens, there is little room for any other carriage on the road. Again, on the main roads near hotels tongas are apt to park two or three deep. This reduces the available road-space for passing vehicles to a bottle-neck and slows down traffic very much.

Again, in some towns and cities the authorities give away many valuable rights to pedlars, hawkers, and shopkeepers, allowing them to erect on public roads stalls, stands, and huts. This is objectionable on many grounds, especially to the heavily-taxed shopkeeper who pays rent. But to stick to the motor driver, these erections greatly reduce the available road-space, and greatly add to the danger run by pedestrians. I notice that municipal boards themselves put buildings on public roads, very frequently at cross-road corners, thus adding greatly to the normal hazard at such a crossing, as they obscure the view.

Again, many pedestrians prefer to walk in the middle of the road, even where traffic is congested, sometimes, I presume, because the side-walks have been converted into market stalls. Another reason may be the fear that the dwellers in the upper stories will exercise their inalienable right to empty slops over the railing, and thus make the pedestrian the recipient of a contribution that he would rather be without.

In a number of countries pedestrians have been educated to walk by the side of the road, and always face the oncoming traffic,

This has greatly reduced the accidents caused by people stepping out in front of cars coming from behind them.

In one city I know in recent years the number of girls' schools has greatly increased. I hope they will still further increase; no expenditure will give more important returns to the nation than that spent on the education of girls and women. Now frequently many of these schools maintain a battery of bullock-carts to bring the girls to and from school. While school is going on, these carts are parked at all manner of angles on both sides of the road, thus making a very narrow passage where only one-way traffic is safe, and greatly retarding the flow of traffic.

It would be easy to go on and give numerous examples of how the rights of road users are taken from them.

But the point is: What can be done to improve matters? Fortunately, the remedy is simple. Get a few lessons into the school readers so that pupils will learn the proper uses of roads and the rights of the public to enjoy those rights without let or hindrance or danger.

Also the boy scouts could be used as as traffic directors; they could talk to drivers, and point out those practices that are dangerous and infringe upon the rights of others.

Again, the police, on their rounds, could be instructed to educate the public on the etiquette of the road. It is a course of education—not of coercion—that is needed. Most of the difficulty is caused by thoughtlessness and ignorance, the remedy for which is teaching, not force—light, not heat. If this campaign of education can be carried out by the various bodies suggested, India would soon become a motorist's paradise where driving would be a pleasure. Nothing has more revolutionized modern society than the motor-car. A good road into a roadless country that is used is as valuable as a university. Roads properly used lead out of narrowness and bigotry and complacent ignorance into a fuller and richer life.

So may not all concerned make the effort to make our roads safe for all the people?

(To be continued)

Citrus growers of Los Angeles county, California, spent $1,308,058 (Rs. 39,24,174) for pest control in the 1932-33 season, treating more than 46,000 acres. The average cost of spraying was about $24 (Rs. 72) an acre, and of fumigating $29 (Rs. 87).

COMPOST: A CHEAP ORGANIC MANURE

By Kunwar Narain Singh, Superintendent of Agriculture
Unao (Oudh)

A great authority on agriculture has well said that, given water and manure, crops can be raised on rocks. In India the monsoon supplies sufficient water to mature most of the Kharif and Rabi crops without irrigation; the deficiency is made up by the artificial sources of irrigation. Thus the rainfall, supplemented by canals, tanks, and well water, has met the first need of the cultivator. The second governing factor of a good harvest is the supply of manure.

In order to maintain the fertility of the soil, we should return to the fields in any form whatsoever what is taken out of them as field produce. A few decades ago, when only the fertile soils were tilled systematically by the cultivating classes only, and the export of the farm produce, which is a permanent loss to the soil, was not so great, the produce per acre was a little more than what an average cultivator ordinarily gets now. But, owing to the rapid growth of population, unemployment, and an increase in the value of food-stuffs, even waste lands are brought under cultivation. Even the non-cultivating classes, with unskilled labour, are now taking to agriculture. The result is inefficiency. Forests which formerly supplied fuel have been cleared to a great extent, and the deficiency of the fuel thus created is now met by dung-cakes, whereby most of the dung is wasted. Thus, with an increase in the cultivated area, the demand for manure increased, while its supply decreased; hence the general complaint of the cultivators nowadays is that the shortage of manure is partly responsible for the poor yields.

The best, and the cheapest, manure is burnt as dung-cakes, and what little quantity is left is thrown away in heaps with the village sweepings, to be blown away by the wind, washed away by the rain, and desiccated by the sun. It poisons the air and water, and adversely affects the health of the village people. Cattle-dung, village sweepings, and poudrette are directly the life of plants, and indirectly the life of planters. What is meat to the one is poison to the other. In the village this stuff is poisonous, while in the field it is as valuable as gold. In the interest of public health, village sanitation, and soil fertility it is therefore absolutely necessary that it should be properly utilized, and the land be considered entitled to the whole of it, without any exception whatsoever.

It has been found that in the supply of plant-food ingredients Indian soils are deficient in nitrates, potash, and phos-

phates only; and chemists have conclusively proved that weeds, straw, and all perishable vegetable matter contain the above three essentials of plant-food, and that they are capable of breaking down into excellent material, approximating more or less closely in appearance and in composition to that of cattle-dung. The Agriculture Department of the United Provinces is fully alive to the necessity of instructing cultivators in the best utilization of the waste vegetable matter to solve their manurial problem; Mr. R. G. Allan Director of Agriculture of the United Provinces, has therefore recently introduced a new method of preparing a compost from the vegetable rubbish which gives four times the quantity of manure in a quarter of the time ordinarily required for preparing manure by the heap system, a description of it is given below.

Since an ordinary cultivator is expected to have at least one pair of bullocks, the following figures are noted to meet his requirements. The size of the pits and the quantity of litter, slurry, and water can be increased proportionately according to the number of cattle.

For one pair of bullocks fifteen pits, 8 by 5 by 2 feet deep each, should be made to deposit the litter. Urine is richer in nitrates than dung, but cultivators, being ignorant of this, do not try to preserve it. To make the best use of this highly-nitrogenous substance, earth is put 6 inches deep in the bullock-shed where the cattle are tied, over which litter containing waste fodder, weeds, straw, and other similar organic matter are spread 2 to 4 inches deep every morning and removed to the pit every 24 hours. It makes a comfortable bedding for the cattle, and absorbs all the urine which would otherwise make the cattle-shed filthy and insanitary. The earth of the cattle-shed is turned over once a week to avoid too much packing and to improve its absorbent power, and it is replaced by fresh earth every fourth month. The earth which is removed from the cattle-shed after this period is stored and used as mentioned hereafter.

One pair of bullocks will give sufficient litter to fill one pit 8 by 5 by 2 feet in six days. When the first pit is filled, the litter should be deposited in the second pit, which, in its turn, will be filled in another six days. Thus the cycle of charging all the fifteen pits will be completed in ninety days. The following operations are done in the pits, and on the ninetieth day, when the fifteenth pit will be filled, the compost will be ready in the first pit, which is then emptied to start a second round of compost-making, when the compost is stored in a heap, preferably covered with earth or leaves, till it is removed to the fields.

The principle of compost-making is exactly the same as that of making curd out of milk. If milk is kept, it will become soured

or curdled in two or three days; but, if some curd is added, it will produce the required change within a few hours. It is the introduction of *lacto* bacillus *acidophilus* which is present in curd (dahi) that hastens the process of souring milk, within a few hours, into curd. Similarly, it has been discovered that the main reagent which is capable of bringing about the rapid rotting of all vegetable matter, and thus of producing a valuable organic manure, is fungus which is a white substance generally seen on semi-rotten leaves If it is introduced into vegetable matter, and air and moisture which are necessary for its rapid development, is controlled, the process of rotting, which takes about a year in the heap system of manure-making generally practised by the cultivators, is finished in ninety days, and gives a compost of a higher nitrogenous percentage. With this principle in view, the fungus is introduced into the litter in the form of a culture solution called slurry, which is prepared by mixing dung-ash, urine-earth, and fungus-starter with water. (The earth which is removed from the bullock-shed after four months is called urine-earth.) Any decomposed vegetable matter which has a white substance on it will serve the purpose of a fungus-starter. To start work in the first pit, it will have to be brought from any neglected heap of farm sweepings or from any manure-pit the contents whereof have not completely decomposed. After a few days it will be available from the first pit in ample quantity. About one seer of rotten vegetable matter with the fungus-starter on it, mixed with an equal quantity of urine-earth and ash and double the quantity of fresh dung, dissolved in a tin or two of ordinary charas (earthen pots) of water, will make sufficient slurry to spread over the litter which is daily removed to the pits from the bullock-shed.

To start compost-making, the litter, which is ordinarily about 15 cubic feet or 4 baskets per pair of bullocks, is collected every morning from the bullock-shed, and is mixed with the surplus dung, one basket of urine-earth, and a quarter of a basket of fungus-starter. This mixture is deposited in the pit and is treated with a tin of slurry every morning after fresh charging. Some water is also sprinkled over the litter if it is not moist. When the charging of one pit is finished in six days, it is left unstirred, till on the twelfth day some water is again sprinkled over it, and on the fifteenth day the pit is turned over by a spade, and water containing a basket of fungus-starter, just sufficient to make it moist, is mixed with it. A fortnight later the litter should again be turned over to give free aeration, and a third turning should be given after a month, *i.e.*, on the sixteenth day from the date the charging commenced. The pit will need no operation after two and a half months, and the compost will be ready in ninety days.

The cycle of the above operations will be continued in every

pit till on the ninetieth day, when the last pit will be filled, the compost in the first pit will be ready. The first pit is then emptied to start the second round of compost-making.

The secret of success in compost-making lies in the proper regulation of moisture and air, which stimulates the growth of fungi in the pits. Too much water will retard decomposition, while the dry litter will take a long time to rot; so it is absolutely necessary to see that the litter is uniformly moist, the temperature fairly high, and the contents covered with the whitish decomposing reagent—fungi. The quantity of water will vary according to the dryness of the material and the atmospheric temperature The presence of proper aeration and moisture guarantees the optimum temperature for fungus activities and the rapid decomposition of the vegetable matter.

Waste fodder, weeds, sugar-cane trash, straw, farm sweepings, and, in fact, every kind of organic refuse, if treated in the above manner, will find its way back to the fields as fertilizers in ninety days. The owner of a pair of bullocks can get by the above method about fifty cart-loads of compost of higher nitrogenous percentage than what is generally got by the wasteful heap system; and, since it supplies a greater quantity of humus, its application improves the physical, chemical, and biological properties of the soil, which, in its turn, ensures higher yields.

This easy and useful method of compost-making has emerged from the experimental stage, and is being practised profitably on Government and on many private farms. Those cultivators who are not getting full produce from their fields simply because they cannot afford to purchase manure and chemical fertilizers should dig a set ot fifteen shallow pits to try this method of compost-making. They are not pits of manure, but are the cultivators' treasuries. Once they have seen the crops raised on the compost, they will never allow any rubbish to go anywhere else but into these pits. Thus their manurial problem will be solved.

India is primarily an agricultural country, and the solution of the manurial problem is expected to solve one of India's greatest problems.

Grazing paddocks should be harrowed and cross-harrowed after the first rain of the monsoon, and, if possible, in the early spring after a fall of rain. The ordinary bazaar spike harrow is the best implement to use.

The most suitable grasses for grazing in Northern India are a mixture of Anjan, Janewah, and Dhub.

FRUIT PRESERVATION

By A. D. Chand

There was a bumper crop of mangoes this year. Kalmi (grafted), especially the Beju (seedling) plants, were simply laden with fruits. Such a heavy crop has not been seen for a very long time. The growers were certain of a large income, and the contractors were anticipating a fat profit.

Just as the fruits developed to a fairly large size, there came a very heavy hailstorm, accompanied with a mighty strong wind, which knocked down practically half the crop, leaving the rest of it bruised and injured. In spite of such a great loss, it was remarkable to note that the plants retained their crops much above the normal. To sell the mangoes knocked down by the storm was a great problem for the contractors. It was rather discouraging to notice a head-load going for a pice, and even less: it did not pay the contractors to pick and cart them to the market. With all their efforts they could not dispose of their stocks, and they had to content themselves with whatever was left on the trees; they trenched large quantities. Just imagine that the ripened Beju were selling from Annas 2 to 4 and the grafted from Re. 1, to Rs. 2-8, a hundred. The range of prices was 75 per cent below the normal.

It is on such occasions and for the enormous surplus supplied that the growers are discouraged. India, in order to supply them with a ready market, needs cottage industrial development; when she produces mangoes in abundance, there is no reason why India should not export, instead of import, fruit products.

It has to be admitted that India is one of the oldest countries which has a taste for fruit products; and India, from the medieval ages, has been famous for producing fruit preparations. There are numerous methods of preservation in practice, even to this day, but the indigenous methods are gradually dying out; the taste for old preparations is no more held in estimation as, with the advance of civilization, the new generation has cultivated an entirely new taste by consuming imported fruit products from other countries.

The factor is in favour of developing new cottage industries in order to meet the demands of the modern taste. India exports tons of fruits every year, and receives, in return, in various forms of preserves, etc., which are then sold at exorbitant prices. There is no reason why India should not use these same fruits in her own industries, thus adding to her wealth, and also providing work for the majority of people, who do not earn enough to keep body and soul together.

There is a large scope for research to be made to improve the methods of preservation of those fruits and vegetables which are already in existence, and to introduce easy and practicable methods of preservation on modern lines.

There is no question, however, that India is making very rapid progress in this particular line. There are several institutions, both private and recognized, where the working of such cottage industries is duly demonstrated for the general public welfare. This Agricultural Institute is one of those which is taking a most active part in the furtherance of these industries.

With a view to encouraging industries, and to enable Indian homes to produce fruit products in their own homes at very little expense, the methods of preparing the various products are given below:—

General Method of Fruit Preservation.—Preserved fruits must retain their form and flavour, and should be crisp, and well seasoned with syrup, and should not be tough or soft.

Preparation of fruit—Fruits should be free from blemishes, washed and, in almost all cases, peeled; and, in certain cases, stoned and cleaned from inside, everything depending upon the type of fruits. Incisions should then be made all over the surface with a pick or fork in order to allow the sugar to penetrate during the cooking process, and also to sweeten the inside. The fruits are then cut into conveniently-sized slices.

Soak soft fruits, and like bananas, guavas, ripe papayas, sweet potatoes, etc., in cold water, hard and acidy fruits in lime or salt-water and in curdled milk or whey, three to twelve hours before proceeding to cook, everything depending upon the nature of the fruits.

Effect of Soaking—

(1) Soft fruits are rendered a little harder, and therefore do not get mashed while cooking;

(2) Hard fruits become porous, and are better fitted to draw in juice during cooking;

(3) Acid fruits are reduced in bitterness and acidity by soaking them in lime and salt-water,and in curdled milk or whey;

(4) Soaking has a remarkable effect on fruits, and prevents them from shrinking and turning stiff;

(5) It has a favourable influence on the internal edible portion of fruits; and

(6) The partial removal of acid from acid fruits is necessary otherwise it inverts the sugar ($C_2H_{22}O_{11}$) into dextrose ($C_6H_{12}O_6$) which does not readily crystallize.

Hard fruits, after soaking in any one of the above mentioned solutions, and washing in plain water, should be cooked for just a long enough period to render them soft and porous. If soft fruits are required to be cooked, it is advisable to introduce a little bit of alum into the water to as to enable the fruits to retain their shape and save them from mashing.

Effect of Consistency of Syrup on Fruit—

There are certain fundamental principles of cooking which should be well borne in mind. There is no question that a certain amount of practical experience is, however, required to turn out well-finished products. I received a couple of reports, after we gave a demonstration of preservation at the Farmers' Fair last year, that fruits failed to obtain good preservation, and also that they were mouldy after a week. This led me to think that a complete process in detail would certainly help in attaining success. It is not altogether easy to obtain good preserves unless the principles of cooking are well comprehended. The following are the most important principles of cooking:—

(1) If fruits are put into too dense or hot juice, the juice from within the fruit will be extracted by osmosis, and consequently it will leave the fruit slices greatly shrunken and deformed;

(2) A thick coating of syrup will also be deposited on the surface of the slices, which will hinder the penetration of the juice; as the slices are not properly salined with sugar, fermentation will soon be set up;

(3) Fruits should be well immersed in the syrup while cooking, otherwise the top slices will dry up and spoil the quality of the product;

(4) The cooking should be done in a deep vessel, and not in a shallow pan, otherwise the syrup will be thickened before the fruits are soft enough to draw in the syrup;

(5) Fruits dropped in to the thick syrup will become tough and leathery, which is the most undesirable character;

(6) Fruits rich in juice may be added into a thick syrup of medium consistency to start with because an abundance of fruit-juice will dilute the syrup; and

(7) Tart fruits may also be introduced into a syrup of medium consistency because the acid present in the fruits inverts the sugar into *diastase that does not readily crystallize.*

From the above it is quite evident that the study of the maintenance of the best suitable point of the consistency of syrup for various fruits should be so maintained as to fit it to permeate the whole fruit without a rendering of toughness or shrinkage.

As a general rule, it would be safe and convenient to start cooking in a fairly thin syrup so as to avoid all dangers of spoiling the product.

Process of Cooking—

(1) The cooking should be started in a fairly thin, and a sufficiently large, quantity of syrup. The quicker, and relatively easy, procedure of cooking is to add the prepared slices in a cool, thin syrup, and then cook them gradually by applying a gentle heat, and thinning the syrup so as to allow the fruits to be fully impregnated with the syrup without shrinking. This process however, requires some skill. The finished product will retain the natural colour of the fruit and a good flavour if it is cooled rapidly, soon after the cooking is finished; and

(2) An immature or inexperienced man can acquire relatively equal success by following the method given in the *Allahabad Farmer* of last May under the heading "Kumquat Preserve."

In brief, make a thin syrup, and, after cooling it, pour it over the prepared fruits. The next day drain off the syrup again, thicken it, and pour it over the fruits. This time leave it for two days, and on the third day repeat the same process, letting it stand for four days, and on the fifth day cook the fruits also in the syrup until the syrup reaches the consistency of honey.

Desi Mango Preserve

Sugar	4 seers
Green Mangoes	2 seers
Salt	2 ounces
Lime	4 ounces

Procedure.—Select mangoes, taking care that they are not bruised, and are free from all blemishes. Peel them very carefully so as to remove thoroughly the outer green coat of the fruits. Make incisions all over the body of the fruits, and then cut them into such pieces as are desired. Make the lime solution in water, and immerse the fruits in it for about three hours. Remove the lime solution, wash the fruits in fresh water, and the put them in a sieve to drain off all the water. Besmear the pieces with finely-ground salt, and keep them covered for an hour; then wash away the salt thoroughly with hot water, and boil them till porous and soft. Drain and shake off all adhering water.

Introduce the fruits into both thin and cold syrups made of sugar and an adequate amount of water. Continue cooking slowly and gently over a fairly slow fire, cutting away the scum that accu-

mulates on the surface until the syrup becomes thick and viscous; remove the cooking vessel from the fire, cool, and keep it in a vessel for some days, before bottling, to see if it keeps well. If it shows any signs of fermentation, boil the syrup with the fruits till the former is pretty thick; then bottle the preserve, and seal it hermetically.

Fazli Mango Preserve

Fazli Green Mangoes	..	1 seer
Sugar	.. ..	$1\frac{1}{2}$ seers
Lime	.. .	2 ounces

Select mangoes, peel, and take proper care of them. Make incisions with a pointed wooden fork. Cut them lengthwise into slices about an inch wide. Soak them in strained lime-water for at least two hours, wash them, and cook them in clean water until they become soft. Drain and shake off all adhering water.

Procedure.—Have a sufficient quantity of thin syrup prepared, using $1\frac{1}{2}$ seers of sugar for every seer of fruits and the requisite amount of water. Throw the mangoes in the syrup and allow them to simmer. Cut away the scum as it appears until the sugar inclines to crystallize. Then remove the kettle from the fire, and take the necessary precautions against the syrup's fermenting, as suggested in the previous method. Finally, bottle, seal, and keep the product in a cool place, and it will keep good for years.

Peeled fruits may be cut half through, and stuffed with almonds, pistochio-nuts, and raisins, after removing the stones, and tie round with thread. Incisions are then made, and the preserve is made in the same way as given above.

Peach Preserve

There are two distinct varieties of peaches: the flat and the round. The former is comparatively tender, soft, and sweeter, and is not very commonly used for preservation, although it can be preserved; while the latter one is rather hard, and comparatively less sweet; therefore it is very widely preserved. The North-West Frontier Province is the home of a large variety of peaches.

Procedure.—*1st.* Select peaches free from injury, wash, and slit them with a silver or silver-plated knife in order to remove the stones. Make a few incisions all over the surface. Boil them for a few minutes so as render them soft; take them out of the water with a perforated ladle allowing all adhering water to drain

(*Continued on page* 27,

THE SUCCESSFUL FARMER

By Jyoti Prasad

Divisional Superintendent of Agriculture, Allahabad

The good old days, when land was plenty and nature liberal to everybody who tried to live through farming, are of the past. It is now no longer possible as it was possible then—according to our ancient tales—to scatter a handful of seed anywhere and expect a crop good enough to support the farmer and his family. Science has helped us in other walks of life, and it seems a paradox to expect agriculture to serve its purpose without any scientific help. Yet what are the bulk of the population of India trying to do? Either they do not know how science can help them, or they have not seen the world where science has developed the methods of agriculture. Probably both conditions apply in most cases. The wants of the average cultivator are not very different from those of centuries ago. In ancient times Indian resources of wealth, as of that of any other country, were a good deal in excess of the wants of the people. They had their fill according to their needs, and allowed the rest to go unutilized. Stationary on the old, old standards of life and methods of farming—the chief industry of India—our country has so far been able to accommodate the growing population. But now it seems certain that science must come to our rescue and make agriculture more productive and economic if the needs of the growing population are to be satisfied. Scientific agriculture can alone successfully meet the growing demand of India. It will therefore be seen that we have now come to a point where we must decide one way or the other—to strive for improvements in agriculture, or to let events take their own course. Obviously, the former is the more desirable one, and needs our keenest attention. The many problems that crop up before us, when we begin to think of improved farming should be already well known to those of us who interest ourselves in the problem. Widespread illiteracy among our cultivators makes them a solid mass quite impervious to any scientific knowledge about agriculture. They have their own traditional methods which they pursue with religious sanctity; and to make any suggestions that may militate against their own methods is to invite the wrath of the gods. As if illiteracy were not enough, there is the appalling poverty of the farmers that keeps away from them certain important advantages. They cannot change their ploughs for better ones. They do not keep any reserve; and, if once they lose their cattle somehow, they run into debt and get involved in the eternal clutches of the money-lender. Co-operation has done something to ameliorate this evil, but without education even co-operation stands little chance of success.

There is yet another drawback of small holdings which is the result of the law of inheritance of the country. Consequently, land is distributed into small pieces, and large-scale commercial farming becomes costly. It is very often the case that a single farmer possesses several small pieces of land in different localities, and no advantage results from possessing more land than others.

From what has been said above we can well imagine the enormous task before the agricultural reformer. It would surely be an ill-advised scheme to give the masses literary education in order to make their minds open to new ideas. Literary education is a luxury which prosperous people may very well indulge in. There should be indigenous agricultural areas where the farmers' children might acquire an elementary knowledge of scientific agriculture, while they should be taught to read and write enough in order to serve their needs. Scientific agriculture should be, however, so carefully adopted to our Indian conditions so as to fit in with the poverty of the people and their small holdings.

The ghost of poverty is indeed the most acute problem and the greatest enemy of our progress. Can we remove this by granting sufficient money to all poor cultivators? The answer is obviously "no;" for the very next day they will cease to work and enjoy and exhaust their treasure. It is not because the cultivators do not get a good start that they are indebted; they are so because their actual income is insufficient. A high rate of interest is not the only cause of this evil. If co-operation affords the cultivator cheap money, that is something, but not all.

It is, however, gratifying to note that, since the passing of the Agra Tenancy Act, the position of cultivators has become more secure, and they will feel better interested in their fields now. But the problem of consolidation of land still remains unsolved. Here also co-operation can step in and help the cultivators to combine and plough large areas on a commercial scale. The activities of the Co-operative and Agricultural Departments can be more profitable if these sister departments work together for their objects are for the most part identical. The Education Department should try to provide schools as suggested above, and impart only such necessary literary education as to make the cultivator reasonable and open-minded and able to understand others. The Co-operative Department should then, through its propaganda, bring home to cultivators the advantage of co-operation, and lead them to merge their fields together and hold their land in the shape of shares of the one big farm. Co-operation can also provide cultivators with cheap money, and also teach them the right spirit of working. Then comes the turn of the Agricultural Department to demonstrate to the peasants scientific methods of cultivation,

lay out schemes for them, and equip them with up-to-date information about the agricultural world. All this sounds very well, but one essential point is that we must have the right type of man if our schemes are to meet with success. The farmer should be a good manager, with good judgment to think out for himself a good locality, and to decide his particular type of farming. He should be equipped with practical agricultural knowledge, and should have a bit of mechanical taste.

If we take up our work on the lines suggested above, and coordinate our activities to produce the right type of farmer, there is no reason why our constructive schemes should not bear fruit and show a rapid amelioration in rural conditions, and why the plodding farmer should not become a progressive farmer.

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off. Make a thin syrup, allowing three-quarters of a pound of sugar to every pound of fruit, and drop in the prepared peaches while it is boiling. Allow them to simmer over a fairly slow fire until the syrup is quite thick. Examine the product after two days; if it shows a disposition to ferment, drain away the syrup, thicken it, and, while it is still hot, put back the fruits. Repeat boiling in case the syrup becomes thin again.

2nd. Prepare the fruits, and, without boiling them, introduce them into a thin syrup prepared as stated above. Continue cooking very slowly over a very gentle fire until the syrup becomes viscous. Remove it from the fire, cool it immediately, and examine it after a few days. If it appears to be thin, reboil it only to the desirable consistency, and, while hot, put back the peaches in it.

This product is wholesome, delicious, and nutritious.

"Tuberculosis and Johne's disease are widespread in India and constitute a serious menace to the improvement of cattle and dairy stock. The early appointment of the Specialist officer sanctioned for the Imperial Institute of Veterinary Research, Muktesar, is an urgent necessity."

"For the sane development of Dairying in India, legislation for the prevention of adulteration of dairy products should be made *obligatory* on Local Bodies and not optional."

PRESENT STATUS OF FRUIT-GROWING IN THE UNITED PROVINCES

By Shanti Raj Swarup, B.Sc. (Agri.), F.R.H.S.

Fruit-growing has, of late, received a fresh impetus from the Provincial Agricultural Department and landowners. The fact that there exists a number of old gardens with comparatively very few newly-planted ones vividly reveals that older generations realized the importance, together with the benefits, of fruit-growing. Mangoes, for instance, have been grown in India since time immemorial. The gardens of the Mogul rulers are famous the world over, and some of the best varieties of fruits were introduced during the Mogul period. The Nawabs of Oudh were responsible for the well-known Dasehri and Safeda mangoes.

The Government Botanical Gardens at Saharanpur were the next to be developed in the beginning of the nineteenth century. Some important fruits were introduced here which, later on, spread to most parts of the provinces.

Mr. R. G. Allan, in his note on fruit-growing in the United Provinces, has stated that during his recent tour throughout the provinces he has seen a number of gardens which were planted a number of years ago, and very few recently-planted ones. This shows that, after the great war, when every other industry was prospering, and agriculture was also in its boon period, landholders cared but little for fruit-growing. Now, when agriculture is faced with a world-wide depression, and the prices of agricultural commodities do not show any prospect of revival, the people have again thought of fruit-growing as a profitable proposition. The Provincial Agricultural Department, encouraged by the Imperial Council of Agricultural Research, has also started to concentrate its attention towards fruit-growing, and every effort is being made to produce a better quality of fruit, but without lowering the tonnage.

The Punjab has about 50,000 acres under fruit, growing a variety of fruits, including dates, grapes, peaches, apricots, etc., and the Bombay Presidency has almost a similar area under fruits, the chief fruits being the mango, chihu, or sapota (Achras sapota), and grapes. But, unfortunately, no such data have been collected, and it is not possible to tell the approximate area under fruit growing in our provinces.

Our provinces, having a variety of climates in their different regions, are growing almost all kinds of fruits; thus the Kumaun division has a temperate climate, with plenty of rainfall and no heat; and the Meerut division has a submontane climate growing

a large number of fruits that can not be grown either in the hills or in the hot climates of Lucknow, Allahabad, or Agra.

The provinces, according to the fruits grown, can be divided into six divisions, each division more or less specializing in its own fruits—

(1) *The Northern*, comprising the districts of Naini Tal, Almora, and Ranikhet, with a cool hill climate and an altitude of 5,000 feet. This division grows mostly apples, cherries, apricots, plums, and other temperate climate fruits;

(2) *The North-western*, comprising the districts of Dehra Dun, Saharanpur, Muzaffarnagar, and Meerut. The important fruits are the mango, litchee, loquat, plum, peach, pear, and pomegranate. Strawberries are quite commonly being grown in the Meerut and Muzaffarnagar districts;

3. *The North-eastern*, comprising the districts of Gorakhpur, Basti, Bahraich, Pilibhit, Lakhimpur, and Kheri, are growing mangoes, litchees, and pine-apples;

4. *The Central*, comprising the districts of Allahabad, Lucknow, Hardoi, Cawnpore, Unao, Rae-Bareli, Barabanki, Fyzabad, Partabgarh, and Farrukhabad. The chief fruits grown in this region are mangoes, oranges, custard-apples, papayas, guavas, melons, water-melons, and bær, or jujube;

5. *The Eastern*, comprising the districts of Benares, Jaunpur, Mirzapur, Ghazipur, Azamgarh, and Ballia. This region grows some of the famous varieties of mangoes, litchees, and chironjis (Buchanania latifolia);

6. *The Southern*, comprising the districts of Jhansi, Jalaun, Banda, Agra, Muttra, and Mainpuri. The fruits grown in this tract are the ones that can be grown in rather hot and dry climates; papayas, phalsas, chironjis, melons, etc., do well here.

One finds very few orchards in or around large towns, most of the fruits coming here being grown in the interior of the district or in neighbouring small towns which cannot find a market for the entire fruits grown. A large majority of fruit-growers consists of zamindars, big or small, who have not undergone any training in the methods of fruit-growing and marketing; hence they are being guided by the gardeners they are able to employ. These gardeners too are not trained, but only work in a garden for three or four years and acquire a preliminary practical knowledge; though not fully qualified, they pose as full-fledged malis. The planting system of these old orchards is, more often than not, defective. Most of the trees are planted haphazard, without any regard either for straight lines to enable interculture through bullock-power, or for correct distance. It has been observed in

many orchards that the distance kept between row to row and plant to plant is generally less than is necessary for proper expansion or thorough aeration of the interior of the plant. For instance, mangoes are planted at a distance of 20 to 25 feet, or litchees and loquats at 15 to 20 feet. No regular system of planting is followed, the square system being taken up only by some growers, the quinquennial oı the hexagonal system being rarely, if ever, adopted. The pits are shallow and narrow, often prepared just enough to receive the ball of earth attached to the plant. The proper dimensions of the pit—3×3×3 feet—are seldom kept. Apart from this, very little manure is added, with no sand or loose material to ensure proper drainage. A depression is always kept in the pit to keep water standing; while, according to modern practice, it is injurious to the growth of the plant. A small mound should be made around the stem, making a shallow channel all round for irrigation purposes.

After planting is over very little after-care is given to the plant but for a few waterings and hoeings whenever extremely needed. Manure is seldom used. No use is ever made of chemical fertilizers, even bonemeal, except only by some of the advanced growers. Protection against frost and hot winds is commonly given.

The plants, after they have come to fruition, are the least attended, although for proper bearing they should be carefully treated. That is why most of the growers fail, or reap less profits than others. It is essential that proper manuring, digging, and irrigation be given at the proper time to as to ensure good fruiting. The amount of manure differs almost with every crop; hence no general dose can be attempted in this note. Ploughing once in the rainy season and again during the winter, a fortnight before the time of flowering, will be very helpful. Thorough digging of unploughed beds should be done. Water should be withheld about a month prior to the flowering season in order to check plant growth and to encourage flowering. After the flowers have appeared, and the fruits set, start with giving small doses of water till in a fortnight you flush the whole field, and then irrigate the crop regularly till the fruits ripen.

The most important problem of marketing has not been tackled by any fruit-growers. The most common practice is to sell the entire garden to a kunjra, or a contractor, who watches the fruits and sells them according to his own wish. Growers receive a very small price as often the contractors combine and offer about half, or a little more, of the real value of the fruits. This system is prevalent all over the country. It is true that growers are faced with many obstacles if they market the fruits themselves. The first difficulty is in watching and checking thefts. Growers, in a

large majority, do not live in their orchards, but reside in cities or villages. Their servants, unfortunately, being low paid, are not honest; hence they do not watch the fruits carefully against human beings, insects, birds, etc., which entail a great deal of loss.

Apart from this, the fruit markets of to-day lack all the necessary rules and regulations that are to be found in the modern fruit markets of the world. The system of fruit marketing in India needs much improvement, and no effort should be spared to effect this, either through the agency of Government or of fruit-growers.

The present practice is to bring the fruits to the market, where all the fruit-sellers gather, and bid at an auction which is held by one of their number. In many of the larger markets they combine and auction the fruits at a very low price which often does not even cover railway freight and other overhead charges. Large consignments of mangoes, litchees, loquats, etc., are sent every year from Muzaffarnagar to the Punjab markets, especially to Rawalpindi, Peshawar, Simla, Amritsar, and Lahore; and the writer has personally seen contractors sending fruits to Rawalpindi, railway freight for which has amounted to Rs. 28-12 per wagon, and other overhead charges, including cartage, packing, octroi, commission, etc., come to Rs. 15-2-6, the total cost thus amounting to Rs. 43-14-6, and the sale proceeds of the wagon-load consignment of mangoes being Rs. 52; thus the income is only Rs. 8-1-6, which includes labour, watching, bother, and personal profits. I think that, if the whole consigment of fruits were sold locally, it would have fetched at least Rs. 40, and the income would have amounted to Rs. 30; thus local sale would have brought in about four times the profit. Sometimes, however, the local market is so glutted that the whole lot of the fruits does not find a market, and hence rots unsold.

Remedies

The formation of a provincial fruit-growers' association in the United Provinces, like those in the Punjab and Bombay, is an urgent necessity to remedy all these evils. The association can solve these problems by appointing expert officers and by sending them to visit the orchards of members at a nominal cost, and to give them advice on improving existing orchards. The vexed problem of marketing can also be easily tackled by the association. It can frame such laws and regulations as to organize markets and force them through the legislature.

The association can establish an information bureau to secure all the market news as to prices and supplies, and thereby advise

prospective fruit-growers to send their fruits to only such markets where they can reap good profits.

The association, in my opinion, should be financed for the first five years by an annual subscription of Rs. 10, and an enactment of 6 pies per maund as extra octroi duty to be realized by municipal boards and transferred to the funds of the association. This will entail no direct burden on either the producer or the consumer, but will fetch a good revenue for the association to enable it to carry on its multifarious duties. After this has become a regular source of income the annual subscription should be discontinued if finances permit. It is the duty of every fruit-grower, large or small, to become a member of the association, and thus encourage the industry of fruit production.

A fair percentage of the total tonnage of the fruits produced in the United Provinces goes to waste or rots every year due to natural causes, such as attacks of insects and fungous pests, unequal balance between moisture and food supplies, and the like. Such fruits can be used in making certain by-products, such as juices, syrups, essences, or even jams and jellies. The other reason for a great deal of loss is that in certain years, when there is overproduction, the entire fruits do not find a suitable market, and hence no use is made of them. Other countries are preserving their surplus fruits in cans and placing them on the markets when fresh supplies are over. Similarly, our provinces should adopt such methods of fruit preservation which will bring in huge profits and present a suitable opportunity for the educated unemployed to earn a living. The United Provinces Government should give suitable aid to this industry, and educate some ambitious young fruit-growers abroad, there being in India no adequate training institute for fruit preservation.

Lastly, Government should appoint fruit experts to give suitable and timely assistance in the planning and upkeep of modern orchards, and also for guidance in the proposed industry of fruit preservation.

I am reluctant to say that Government has been lending a deaf ear, so far, to the various appeals made through the Press under the false plea of financial stringency. Government and fruit-growers should combine to give an impetus to fruit-growing and fruit preservation, and also find out suitable methods for storing fruits.

Some suitable research schemes and experiments should also be started at all Government gardens, and by the association at selected orchards of individual fruit-growers.

NOTE ON FEEDING FOWLS

The Method Used on the Mission Poultry Farm, Etah, U.P.

In the morning a feed of grain composed of wheat (gehun) maize (makka), and great millet (juar), about equal proportions of each, one handful to each fowl, i.e., about 2 oz. If the birds are not on free range, in order to induce exercise, the grains should be scattered in a litter of dried leaves, dried grass, bhoosa, etc., about 6 inches in depth, to keep them scratching for it.

At noon they get all the green food they ean cat which, in the winter, consists of such things as cabbage leaves, cauliflower leaves, chopped lucerne, etc., or whatever is available from the vegetable garden. Doob grass, if available, is also very good. They will usually eat about 2 oz. each of green food.

In the evening I give a moist mash, all they can eat, which will again be about 2 oz. for each fowl. The mash is made up as follows:—

$\frac{1}{3}$rd cooked minced meat. I buy from the slaughter-house what is commonly known as ratab (paunches, lights, etc.). This is non-stimulating white meat, is very nutritious, and can easily be bought from 6 pies to 1 anna per seer; $\frac{1}{3}$rd cooked vegetables, using whatever is available. Pumpkins, turnips, onions, etc., are all good. I use whatever is in season and easily procurable; and $\frac{1}{3}$rd atta, consisting of a mixture of wheat atta and bejhar ka atta in about equal proportions. The minced meat, cooked vegetables, and atta should all be thoroughly mixed and fed in a moist and crumbly condition, i.e., not sloppy; a little practice will enable one to know how much water to use; the same water in which the meat and vegetables are cooked is the best.

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Then there is the question of the length of lactation. This must always be taken into consideration, and also the reason for a cow going dry. Too often cows go day early not because the owner is desirous of getting another calf as soon as possible, but because their yield is drying up fairly fast.

Such cows may be high yielders during the first stages of their lactation, but quickly dry up. Of more importance is the cow that never becomes a phenomenal yielder, but gives a fair amount consistently and persistently. As far as we know persistency is an inherited characteristic. *Ayrshire Cattle Society's Journal.*

THE RECORDING OF MILK

Methods in Vogue in Europe and America
Advice to the Constructive Breeder

By A. D. Buchanan Smith

Animal Breeding Research Department
University of Edinburgh

Milk recording is not an end in itself; it is a means to an end. It serves a threefold purpose: Firstly, milk recording is an index of the health of an animal; secondly, it guides the cattle-man in his feeding; the non-productive animal gets less food, while to the good producer is given more; and, thirdly, an intelligent interpretation of milk records enables a sound constructive breeding policy to be prosecuted by the owner.

Since by this last means a permanent improvement in the herd can be achieved, it is therefore essential that a progressive breeder should not only record the milk production of his own cows, but also make an intelligent use of the published milk records of any animals which he is thinking of bringing into his herd..

This brings us to a consideration of milk recording itself. There are many systems of recording, and at the present moment there is much disputation as to which is the best; that is to say, which gives the fairest return and information to the breeder. In England, as in Denmark, the annual lactation of the cow is not used as the basis for the record, but an arbitrary period is selected and the yield of the cow during twelve months is registered. This is not very logical. It is difficult to see the value of a record which is estimated from October to October when the cow calves in the spring.

The Danes are considering the possibility of changing over to the system to which we in Scotland are accustomed—of registering the yield from the day of calving. They appear to be unwilling to do so in the meantime since they have employed the old system for so many years. However, the very fact that the authorities there are seriously considering a change is interesting. This one detail serves to illustrate the wide divergence in the methods of recording. There are many others.

The Ideal

Let us consider the ideal. First of all, a primary requisite is that every animal in the herd must be tested. There are bulls which leave only high-yielding daughters, but the majority of bulls leave daughters of all grades. If only the records of the high-yielding daughters are made, then a very misleading opinion may be formed concerning the value of the bull. Thus, for constructive breeding, the first essential of milk recording is that the yield of every cow in the herd be measured.

The American Dairy Science Association has come out strongly for the herd test as a basis for advanced registry in the United States. The herd test is of recent origin "over there," and we may be sure that it was not started six years ago without a very full consideration of all possible methods. In fact, the other methods of advanced registry which had been tried out were found wanting, and it was logical that steps should be taken in the direction of herd testing. The American Ayrshire Breeders' Association, knowing the good work of the herd test in Scotland, was the first to apply it in America.

Frequency of Records

Another important point would appear to relate to the frequency of the records, combined with their reliability. By the English method cows may be recorded by the farmer daily or else weekly. The herds in England are visited by the recorder about once in every six weeks, when he merely checks the farmer's measurement. In Scotland, on the other hand, a specially-trained recorder visits the herd once every three or four weeks, and it is on his record that the lactation is based.

Undoubtedly daily records are better than weekly and weekly than three-weekly, but again we must remember that it is not every farmer who is honest; and it is a fair question to ask whether it is not safer to calculate the lactation of a cow from figures taken by an independent authority rather than by the owner or his agent, who is naturally apt to be prejudiced.

Surprise Visits

Unless a very good system of surprise visits can be arranged, then the weekly and daily weighings by the owner of the herd are not to be compared for reliability with the Scottish method. And, further, it must be remembered that the recorders in the Scottish system are themselves being checked by surprise visits of the supervisor. There is certainly less room for the dishonest man under the Scottish than the English system.

As well as the fact that for breeding purposes the record should be based upon the lactation, and not upon an annual yield, it is important to take into account the question of quick calving. This is done both in England and in Scotland by publishing in the records the date of the last, and of the next, calving of each cow. In the English register there is a special section for cows which have given a specified yield over a three-year period, provided that they have calved three times within that period.

Again, quantity is not everything; quality must be taken into account, and experience all over the world has shown that, to be reliable, butterfat must be measured on the farm.

The Scottish Milk Records Association gives quite a useful index figure of quality and quantity which consists of multiplying the total milk in gallons by the percentage of butterfat, which is then called "Yield of milk of 1 per cent fat." To get the total butterfat yield, one merely knocks off the last nothing in this figure. Thus a cow may give 714 gallons of 3·5 per cent fat. This gives an index figure of 2,500 gallons at 1 per cent fat, or 250 lb. of butterfat.

The Canadian record of performance is better than this. It states the total pounds of fat yielded by a cow during lactation; for constructive breeding this is more important than a figure representing percentage butterfat. The official English system pays no attention to butterfat, testing for which is optional, and usually expensive; and, even then, the tests are not always for the complete lactation period.

Presentation of Results

Another important point is the method of the presentation of the results. In both the Scottish and English methods the results are published in alphabetical order according to the name of the owner of the herd. Any use which the English results may be for pedigree purposes is negatived by the fact that the numbers of the pedigreed animals are not published; thus it is exceedingly difficult to check statements by owners concerning the production of their cows. It can be done by the ear numbers, but this is an exceedingly cumbersome way of checking when the whole point about milk records is that they should be easily available.

In the Canadian record of performance the animals are published in the alphabetical order of their names, and their herd book number follows the name. It is thus very easy to trace the milk record of animals and their pedigree. At the end of the record is an index of owners.

List of Bulls

Both the English and the Canadian records have lists of bulls. In the English the qualification is based either on the dam and the dam of the sire, who must have given not less than the standard yield prescribed for their breed, while there is also another list of bulls which have two or more daughters who have given not less than the standard yield prescribed for their breed. The Canadian list consists of bulls with at least four daughters by different dams which have come up to the standards required for the record.

For constructive breeding it is of every much less importance that a list of bulls should be made whose ancestors have done well than that a list should be made of those bulls which have proved themselves to be good breeders by the performance of their daughters. The small number of daughters which is necessary for the second bull section of the English register of dairy cattle is almost ridiculous; the Canadian number is small enough; and, in any case, the yields of the dams should be published alongside those of the daughters. It is of the utmost importance to know whether the bull has increased the yield of his daughters over those of their dams. However, this is almost another story, as is the question of the 305-day test compared with the 356-day.

The object of this article is to point out the divergence existing throughout the world in the methods of milk recording and the importance of milk recording for the constructive breeder. The Scottish method may not be ideal, but it is undoubtedly one of the best in the world, and one that has been largely copied in other countries. The method which we adopt of supervising our records is the admiration of the executives of the various cow-testing organizations across the seas.

Age

The majority of investigators of various breeds agree that the maximum yield of milk is given by a cow when she reaches seven years of age. The same holds good for the total butterfat yield. The butterfat percentage is, as a rule, highest in a heifer's lactation since the increase in the total butterfat yield is proportionately not so great as the increase in the total milk yield.

The accompanying table was drawn up by Dr. M'Candlish and Mr. Kay, and shows the calculations which should be made in studying the yields in order that they may be brought up to the same level as the mature yield. To calculate the yield of a cow of any age you multiply by the figure given in table I below:—

Table I

Age in Years	*Milk Yield*	*Fat Yield*
3	1·16	1·13
4	1·12	1·12
5	1·06	1 05
6	1·03	1·03
7	1·00	1·00

Dr. M'Candlish also says that the age at first calving is of some importance as it affects the ultimate yield which a cow may give. The best age at which to calve Ayrshire heifers for the first time is around 2½ years. That means serving them about three months before their second birthday. Actually Dr. M'Candlish found that there was a small, but consistent, decrease in the ultimate yield of heifers as their age at first calving advanced from 2½ to 3 years.

Month of Calving

Dr. Sanders has shown that the month in which a cow calves is of considerable importance. He has not worked with Ayrshire cows, but his figures at least give a fair indication and a rough guide on which to use our intelligence. Those cows which calve in the autumn, particularly in the month of October, give a better yield than those calving at other times. For instance, if the average cow calved in October, she would give 720 gallons, whereas, if she calved in June, the yield would be only 640 gallons.

Dr. Sanders discovered that there was a considerable difference from breed to breed in this respect. Taking the months one by one, we find that January calvers are slightly above the average, February calvers are somewhat more above the average, while March calvers are just average, April calvers are slightly above the average, but May calvers are appreciably below, while June calvers are very much below.

You get roughly 7 per cent less milk from a June calver than you would get from the same cow if she were to calve in March. July and August calvers are also 5 per cent and 3 per cent respectively below the mark. September has but a very slight depressing effect, while a cow calving in October gives almost 5 per cent more milk than if she were to calve in March, and 12 per cent more than if she calved in June. November calvers give about 2·5 per cent more than the average, while December calvers are in the same class, but do somewhat better than the November ones.

Service Period

By the service period is meant the length of time between calving and service. Naturally, it has a big effect upon the milk yield, especially if the interval is small. Again I must refer to the work of Dr. Sanders at Cambridge University.

He discovered a difference between breeds, and also a difference between first calvers and others. If you take the standard interval between calving and service as 85 days, you get a cow calving again in exactly one year. This is used as the basis of table II below. However, Dr. Sanders is of opinion that, from an economic point of view, the best interval between calving is 13 months. This extends the service period to 115 days:—

Table II

Effect of Service Period (in gallons) (After Sanders)

Service Period Days	*First Calvers*	*Others*
0- 19	481	547
20- 39	520	604
40- 59	558	655
60- 79	592	700
85	616	733
80- 99	623	741
100-119	652	778
120-139	679	811
300-319	844	991
400-419	895	1,037

Dry Period

The time during which a cow is dry must have a considerable effect upon her subsequent lactation. We ourselves like a holiday from our work, and so does the cow. Both Dr. Sanders and Dr. M'Candlish have shown that there is a pronounced effect from the dry period next before that one which precedes the lactation.

In other words, the effect of a rest upon the cow may affect not merely the yield of the lactation immediately following, but also that of the next lactation. As long as the dry periods are at least twenty days, little correction need be made. It is, however, better that the dry period should be extended to 40 days if at all possible.

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KIOSK IN COUNCIL CHAMBER*

Enterprise of a U. P. Department

Plea for Better Farming

A kiosk, which is very much like a small museum, showing through its posters, charts, and models various samples of improved economic products of the provinces and other agricultural exhibits, and the activities and the work of the Department of Agriculture has been temporarily installed in the central hall of the United Provinces Council Chamber. To the casual visitor the kiosk, with its tapering dome, appeals as a fine structural decoration; but, apart from this, it has an educative value which cannot fail to be appreciated by a closer observer.

It is hexagonal in cross-section, and each face of the hexagon (except the one which has three parts) is divided into two sections. These sections are devoted to the illustration of the good work of the Agricultural Department under suitable headings like "Cattle Improvement and Fruit Culture," "Farm Crops, Improved Canes, Wheat, and Jowar," "Tillage and Manure," "Insect Diseases and Their Control," "Agricultural Engineering and Machinery," and others.

Array of Exhibits

Under each head there is a regular array of exhibits, and information which should be of great interest to the public in general, and to the members of the farming community in particular, when on view at the prominent railway stations.

Thus under "Farm Crops" are exhibited samples of improved types of wheat, paddy, barley, and other grains, as also the various economic crops like oilseeds; and their utility is brought home to the onlooker by means of figures of actual crop yields, photographs of standing crops of these types taken side by side with low-yielding local varieties, and such other adjuncts.

Under "Insect Diseases" is shown very effectively the great damage done to cotton by the pink boll-worm every year, and the efficacy of the control measures advocated by the department and based on the reliability of large-scale field experiments over several years.

Again, the fruit culture section contains a number of orchard models showing the correct method of planning various orchards and of tending them at different stages. It is interesting to note that such kiosks have also been fixed up at the Bareilly,

(*Continued on page* 47)

*The Pioneer. December 7th 1933.

LIME MORTAR VERSUS CEMENT MORTAR*

FOREWORD

In India, when consideration is being given to the kind of cementing material which is to be used for a particular work, the engineer has not the latitude of choice which confronts his fellow-worker in other countries. He is not called upon to study the suitability of many different types of lime or a vast number of special cements; his choice is invariably restricted to the particular kind of lime available locally or a Portland cement having normal or rapid-hardening properties. The choice too is oftentimes clear where specialized requirements have to be met making the use of cement essential.

As might be expected of a material which has been in constant use for buildings and structures since the earliest times, a mass of data relating to the strength and properties of different kinds of lime mortars is now available, but this does not appear to have been collated with similar data relating to cement mortars, which possibly accounts for the more general use of lime in building works in India, its basic cost being not infrequently eight or nine times less than cement. Such disparity in cost must, at first sight, appear to place cement beyond consideration for ordinary masonry structures, but this, we think, is mainly due to the dearth of authoritative information on the strength of lean cement mortars and a lack of appreciation of what really constitutes cheapness.

CHEAPNESS OF MORTAR

The cheapness of a mortar depends only in part on the cost of the basic material. It depends to a much greater extent on the sand-carrying capacity of the basic constituent lime or cement, and engineers are giving practical effect to this very important factor in modern building construction by substituting lean cement mortar for lime motor, thereby obtaining equivalent, or, in some cases, greater, strength *without increase in cost.*

CHARACTERISTICS OF LIME AND CEMENT

Lime paste is never used alone as a binding material, whereas neat cement grout is in common use for such a purpose. Lime shrinks considerably on drying and hardening, and the addition of sand is necessary in order to reduce the shrinkage and prevent cracking, which would result if a paste of lime and water alone were allowed to dry. In addition, the sand renders the mass

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Indian concrete Journal* **September 15th, 1933.

more porous, facilitating the absorption of carbon-dioxide from the atmosphere upon which the ultimate hardening depends and increases the resistance of the mortar to crushing.

The setting and hardening of lime mortar is an extremely slow process, dependent as it generally is on the re-formation of calcium carbonates through the absorption of carbon-dioxide. The action, though a progressive one, is, of necessity, extremely slow in the case of a comparatively thick structure.

Cement differs from lime in containing large proportions of silica and alumina. It consequently sets much more quickly than lime. It does not slake on the addition of water, thus contrasting with lime.

Both lime-sand and lime-sand-soorkhi mortars are used in this country, the addition of the latter increasing the air passages in the mortar, thereby facilitating the drying and carbonizing action of the atmosphere. In the case of kankar limes, little or no soorkhi can be added on account of the amount of clay already present.

Preparing Lime and Cement Mortars

In preparing lime mortar, the lime is first slaked by sprinkling with water, the requisite amount of sand is added, and the ingredients thoroughly mixed. On a large works this process is usually performed in a mortar mill.

Cement mortar is prepared differently, the sand and cement being first thoroughly mixed in the dry state, and thereafter the water is added.

Lime varies in quality and character in different districts and in different deposits; its strength factor has more often than not to be based on the results of experiments on samples which ultimately prove unrepresentative of the bulk supply. *Portland cement, on the other hand, is a high-class manufactured product sold under guarantee to comply with the requirements of the British Standard Specification in every respect. Its strength factor is a clearly-defined minimum at a certain age either neat or in conjunction with sand.*

Sand-carrying Capacity

The proportion of sand and/or soorkhi to lime paste usually specified is 2:1, *i.e.*, 2 parts sand to 1 part lime. The sand-carrying capacity of the lime rarely exceeds 4 parts sand to 1 part lime. Portland cement, on the other hand, has great sand-carrying capacity, proportions such as 1 part cement to 8 or even more parts of sand are common practice.

Engineers' Opinions on the Use of Lean Cement Mortar in India

As an instance of the suitability of lean cement mortar for masonry structures, the following remarks by Mr. C. C. Dangoria, M.Sc., A.M.Soc.C.E., of the Hyderabad City Improvement Board, are extracted from his article in the December, 1932, issue of the *Indian Concrete Journal:* "As all engineers know, the grinding of lime mortar is an extremely slow process, and to cope with the demand for large quantities of mortar for the construction of a retaining wall along the river-bank it was decided to use cement in place of lime. Once again cost was an important factor, and after a number of experiments and tests one bag of cement ($110\frac{3}{4}$ lb. net) was allowed to 20 cubic feet of sand, care being taken that the sand was not too fine (15 per cent retained on a $\frac{1}{8}''$ mesh sieve). The resultant mortar gave most satisfactory results, and was instrumental in getting the work completed in little more than half the allotted time.

"Engineers operating in districts, particularly those where lime is difficult to obtain, may be assured that 1:16 proportions will give them much greater strength than the best lime mortar of 1:2 proportions. The crushing strength of the cement mortar used for the above work averaged 400 lb. per square inch, and it was found advisable to mix it not too wet."

Mr. C. I. Stabler, M.I.E., District Engineer, Bridges, Bengal Nagpur Railway, in his series of articles published in *Indian Engineering*. July 16th, 1932, page 52), says: "Provided good, clean sand is available, a 1:6 mixture will produce, after a month's setting, as hard a mortar as can beproduced with Gooting lime in any period. Present-day Indian cement is infinitely more reliable than any Gooting lime could ever be, and in certain places and circumstances a 1:6 cement mortar is actually cheaper than a 1:2 Gooting lime mortar."

Mr. J. A. Mitchell, of Messrs. J. A. Mitchell & Co., Analytical and Testing Laboratories, Bombay, says: "1:8 cement mortar gives better results than 1:1:2 lime-soorkhi mortar."

Mr. T. R. Ramaswamy Iyer, B.A., C.E., District Board Engineer, Vizagapatam, says: "I prefer to use a lean cement mortar rather than the best of lime mortars as it will be very difficult to ensure the quality of lime delivered at the work-spot."

Deterioration in Quality of Lime.

The two varieties of lime in general use are (*a*) shell lime and (*b*) kankar, or stone lime. The use of the former is generally

restricted to plaster work and whitewash, and the latter for general building purposes.

There were times, long since passed, when the demand for stone lime was limited; and, in consequence, fresh lime was always available, burned as required from a kankar having a high calcium carbonate content and by means of locally obtained wood or charcoal. Increased building activity has resulted in lime burners being called upon to keep large stocks on hand, and it is by no means uncommon to find quantities of dead, or partially-dead, lime coming in on important building constructions. Moreover, keen competition has brought about the general use of screenings from railway engine ashes for fuel burning, resulting in most undesirable adulteration to the product. Improperly or carelessly-burned, material, intermixture of dirt, and partially-slaked particles are usually guarded against in official specifications, but the difficulties incurred in continually checking the standard of quality at work-site leave the lime supplier many loopholes of escape in the event of complaint, and there are few who will contend that lime, as manufactured to-day, is not greatly inferior to that of former times.

Improved Quality of Portland Cement

As lime has deteriorated in quality, so has Portland cement improved. The original patent taken out for its manufacture is but 100 years old, and, since 1904, when the first "British Standard Specification" made its appearance, there have been continuous revisions, the last only two years ago. The demand for this specification makes cement complying with its requirements a really first-class article, and absolutely reliable in every way. It is as well, in referring to the matter, to record that all brands of Indian cement exceed those requirements.

Mixing of Lean Cement Mortars

The best results with cement mortar are obtained by thoroughly mixing the cement and sand in the dry state and then adding the water. Pouring water on the dry mix from a chatti or sprinkling by hand results in the cement coating to each particle of sand being washed off. What is to be aimed at is, having coated each sand-grain with dry cement, to retain that coating, when, instead of a dry cement powder forming the coat, it is a wet paste. The only way to be sure of accomplishing this, in hand-mixing, is to add the water through a garden watering-can fitted with a fine rose. The gentle spray will set the cement coat, but not wash it away.

ROTHAMSTED EXPERIMENTAL STATION

HARPENDEN, HERTS

Annual Report, 1932, 227 Pages, Price 2s. 6d.

Obtainable from the Secretary

Why continue agricultural research at a time when many farmers cannot sell profitably what they do produce? The answer is to be found in the words of Sir John Russell in this report: "Scientific investigations in agriculture are primarily for the purpose of obtaining information, and this will always be needed so long as farming continues. It is in times of difficulty that expert information about soils, crops, and animals is most valuable to farmers for it enables them rapidly to alter their methods in accordance with the rapidly-changing economic conditions." The work described in the report shows the type of information that is being gained in order to deal with changes in modern conditions.

The farm has developed greatly in buildings, in ordinary farming operations, and in numbers of experimental plots. Further, equipment is now complete for examining the application of recent technical developments in agriculture. Electric light and a wide variety of electric motors are installed; also rubber floors and road paving, and pneumatic tyres on farm carts and tractors. The merits of these in practice are being critically examined.

Improvements in field experiments through the further application of statistical methods are recorded and illustrated by the results obtained with a number of crops. The value of these methods is that they both reduce the error of the results and make an estimate of the accuracy of the experiment possible. Some of the results—for example, those obtained with sugar-beet—illustrate the need for still more information in everyday farming problems. Why is it that no amount of manuring has overcome the difference in yield between beet crops in adjacent fields, where one field may produce twice as much root as the other? In connection with the manuring of sugar-beet, the value of ordinary agricultural salt has proved unexpectedly high, being no less than that of potash.

Experiments with other crops—potato, fodder mixtures, kale, grassland, wheat, and rotations—are described. The inoculation of lucerne, and now of clover, is being closely studied in field and laboratory. The extent to which insect and fungus diseases have infested the two farms—at Rothamsted and at Woburn—is described in detail, and there is a most interesting summary of farm operations for the year in the farm director's report.

Barley receives especial attention in the 1932 report, in a summary of the striking results of ten years' investigations conducted in the laboratory and in the field all over England, under the research scheme of the Institute of Brewing. The practical applications of the results are clearly set out in reference to methods of cultivation, manuring, and the effects of weather and season.

In the laboratory section of the report the soil physics department describes further progress in the comparison of rotary with other forms of cultivation and in the interpretation of soil "tilth." The chemical properties of the soil are being studied by new methods, applied in particular to changes in soil organic matter as a result of different cropping or manurial treatments. The biological decomposition of organic matter is still under investigation, new information being obtained about the rotting down straw, a surplus material that may be troublesome to deal with under mechanized farming. The purification of the effluent of sugar-beet factories by biological oxidation in filters has been carried satisfactorily to the semicommercial scale; the effluent of milk factories is now being studied.

The work on plant diseases well illustrates the range of problems to be tackled. In a bacterial diseases of cotton from the Sudan unusual stages in the life-cycle of the bacteria were found; the genetics of a fungus were studied over many years, and related to the behaviour of natural infection, in virus diseases—those caused by agents too small to be seen under the microscope, further progress was reported. The actual way in which the virus influences the plant and travels about its tissues, and the manner of its carriage by insects, are being elucidated. Insect pests receive special study, notably in relation to the enormous fluctuations in the numbers that occur; and an attempt to relate these to weather changes is in progress. Automatic recording or trapping devices play a part both in this investigation and in a study of the work and the daily life of the hive bee. Methods of insect control by the use of vegetable products as insecticides continue to be studied. Pyrethrum, a very potent agent which can be grown in this country, offers problems both in the cultivation and in the preservation of the toxic principle; those intriguing tropical plants that are used by natives as fish poisons are often valuable insecticides, but it is important to be able to measure their toxicity readily, and methods for doing this are being compared.

In the Punjab, the local Government has enpowered District Boards to frame regulations for the castration of scrub animals. This should be brought to the attention of other Governments for for similar action to be taken."

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE FARM

October, 1933

Date	Max. Temp.	Min. Temp.	Mean	Humidity	Atmospherine Pressure	Rain for Day	Rain Since	Direction of Wind
1	90	75	82 5	68	29·54	..	26·38	S
2	90	78	84·0	72	29·56	..	..	W
3	90	74	82 0	70	29 50	..	..	WSW
4	91	73	82·0	68	29·52	..	..	W
5	91	73	82·0	65	29·56		..	W
6	94	75	84·5	63	29·58	..		WSW
7	93	75	84	65	29·54	..	..	W
8	94	75	84·5	64	29 56	..	..	W
9	95	76	85 5	62	29·55	..	..	W
10	94	72	83·0	77	29·60	..	..	Calm
11	92	72	82 0	70	29 54	..	..	..
12	94	74	84·0	65	29·57	.	..	E
13	95	75	85·0	73	29·37	..	..	E
14	94	71	82·5	77	29·56	Trace	..	NNW
15	90	72	81	76	29·57	..	..	NNW
16	92	72	82	76	29·50	·40	26·78	NNW
17	90	74	82	78	29·50	Trace	26·78	ENE
18	88	76	82	90	29·54	..	26·78	NNE
19	88	78	83	86	29·52	Trace	26·78	ENE
20	83	76	79·5	88	29·36	·45	27·23	ESE
21	78	73	75·5	97	29·40	·86	28·09	W
22	78	72	75	80	29 52	·03	28·12	WSW
23	82	67	74·5	73	29·64	..	28·12	W
24	84	62	73	58	29·76	..	28·12	WSW
25	84	62	73	56	29·74	..	28·12	WSW
26	82	61	71·5	54	29·68	..	28·12	SW
27	83	60	71·5	57	29·72	..	28·12	W
28	82	59	70·5	62	29·74	..	28·12	WSW
29	82	57	69·5	63	29·78	..	28·12	W
30	82	57	68·5	65	29·68	..	28·12	W
31	82	56	69	61	29·68	..	28·12	Calm

(*Continued from page* 40)

Allahabad, Cawnpore, and Lucknow railway stations, and which amply reward a visit and inspection.

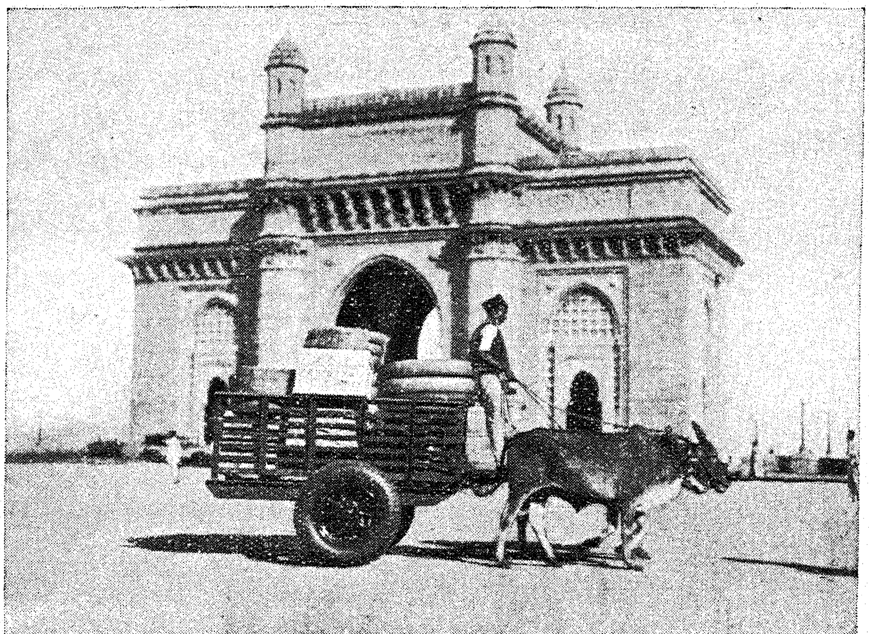
Already they have become centres of great attraction for village farmers visiting the railway stations, and have brought them closer to the department and to the amenities it holds out to them in the shape of seeds of improved crops, approved fertilizers, scientific advice, and general service. The credit for this fine achievement goes to the Director of Agriculture.

November, 1933

Date	Max. Temp.	Min. Temp.	Mean	Humidity	Atmospherine Pressure	Rain for Day	Rain Since	Direction of Wind
1	80	56	68·0	60	29·70	..	28·12	WNW
2	80	56	68	56	29·64	..	28·12	SW
3	80	56	68	59	29·62	..	28·12	W
4	80	56	68	58	29·60	..	28·12	WSW
5	81	56	68·5	60	29·68	..	28·12	W
6	82	56	69	58	29 72	..	28·12	W
7	82	56	69	64	29·72	..	28·12	W
8	81	56	68·5	66	29·72	..	28·12	WSW
9	80	54	67	60	29·74	..	28·12	Calm
10	79	54	66·5	54	29·74	..	..	WSW
11	79	52	65·5	56	29·68	..	28·12	W
12	78	50	64	57	29·70	..	28·12	W
13	78	50	64	56	29·75	..	28·12	W
14	79	50	64·5	58	29·76	..	28·12	W
15	79	51	65·0	67	29·72	..	28·12	W
16	79	53	66·0	73	29·77	..	..	W
17	76	54	65·0	77	29·80	..	..	Calm
18	76	54	65	68	29·82	..	28·12	E
19	79	60	68	69	29·84	..	28 12	E
20	77	57	67	69	29·82	..	28·12	ENE
21	80	63	71·2	88	29·80	Trace	28·12	W
22	78	58	68	88	29·70	..	28·12	Calm
23	79	60	69·5	82	29·74	..	28·12	NNW
24	79	57	68·0	74	29·78	..	28·12	ENW
25	78	51	64·5	83	29 80	..	28·12	SW
26	76	48	62	85	29·80	..	28·12	NNW
27	77	49	63	88	29·80	..	28·12	W
28	75	49	62	80	29 79	..	28·12	W
29	76	50	63	66	29·86	..	28·12	W
30	74	51	62·5	68	29·80	..	28·12	WSW

Village grazing grounds could be much improved simply by bunding and periodical harrowing.

"Grass silage is the corner stone upon which the Military **Dairy Farms** have been built up."



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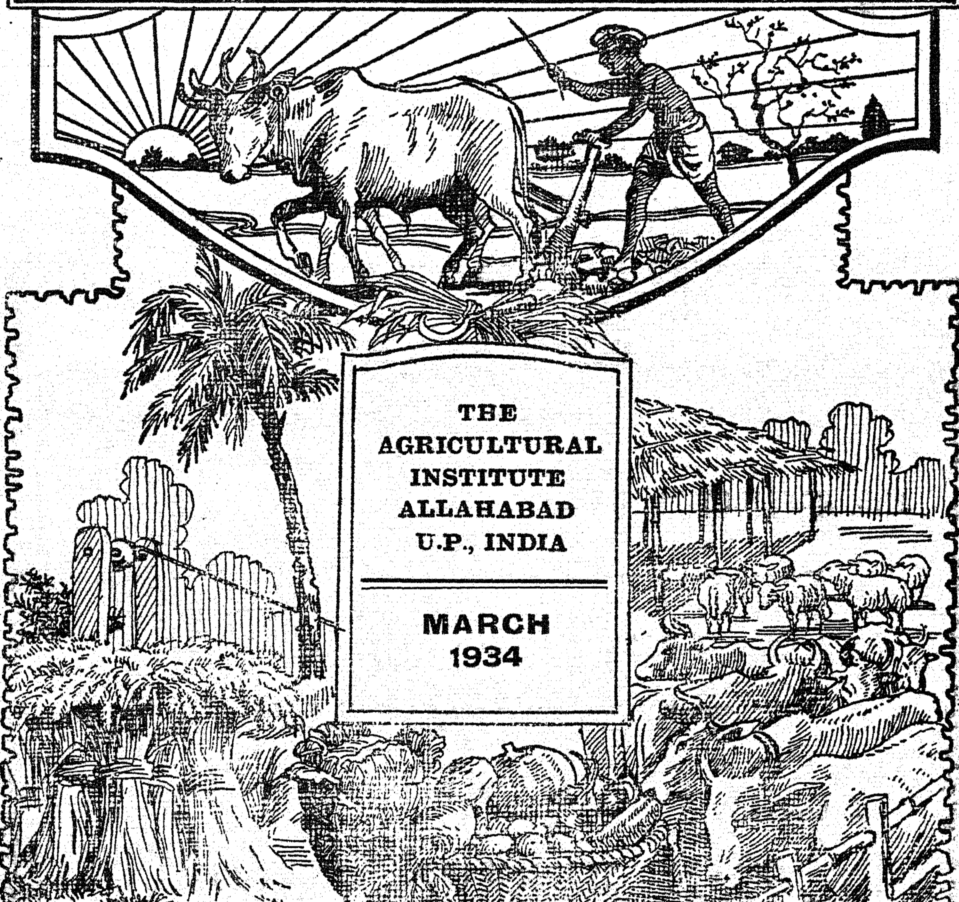
THE ALLAHABAD FARMER

A bimonthly Journal

OF

Agriculture and Rural Life



THE
AGRICULTURAL
INSTITUTE
ALLAHABAD
U.P., INDIA

MARCH
1934

One of the greatest stumbling blocks to the sane development of the Dairy Industry in India is the lack of adequate legislation and control with regard to the production, manufacture, and sale of Dairy Products so as to protect the consumer-purchaser and eliminate unfair and unscrupulous competition amongst producer-distributors. It is to be hoped that the Imperial Council of Agricultural Research, the Provincial Governments, and Municipal Boards and public-spirited citizens will make a strenuous effort to remedy this situation in the very near future.

W. J. HANSEN, B.S.A., M.Sc.
Agricultural Institute, Allahabad

Carnation "Contented" Cow

YOU have, perhaps, heard of "Milk from Contented Cows?"

Well! This is the home of "Contented" cows.

There are hundreds of Carnation "Contented" cows, big, beautiful, heavy-producing animals whose sons carry this tendency to other herds.

Carnation Farms were founded twenty years ago by the Carnation Milk Company for the purpose of breeding young bulls that would transmit production.

The sons of the cow pictured here have gone to three different parts of the world and have made good in each place.

You, too, can just as well use one of these Carnation bulls on your herd. We handle all the details of shipping and give you a price delivered at your nearest port.

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The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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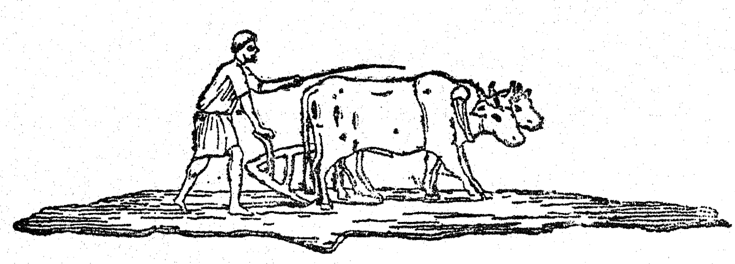

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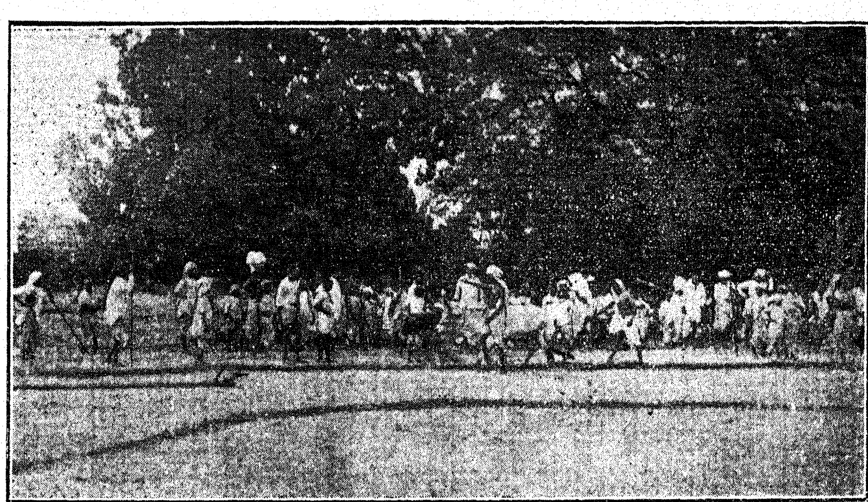
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION—SERAI AQIL

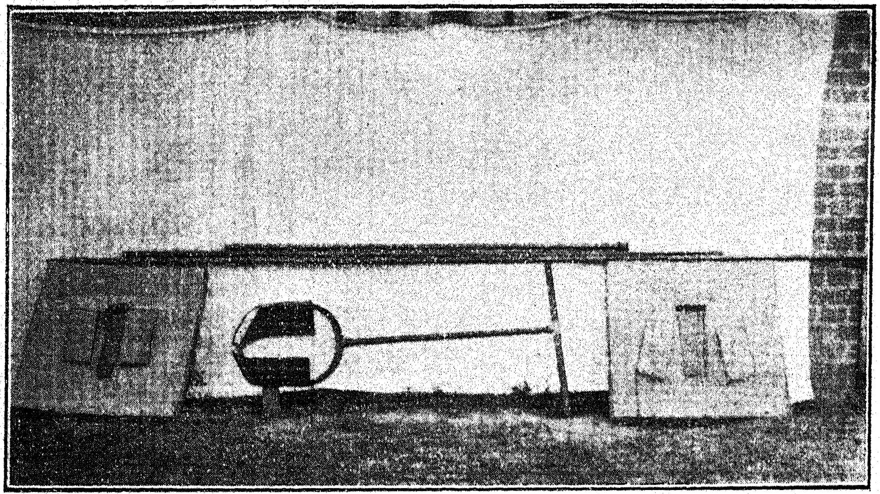
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE ALLAHABAD FARMER

VOL. VIII] MARCH, 1934 [No. 2

Editorial

India Question Raised in Commons

THE purchase by a Government of India officer, Captain C. E. Macguckin, of seven Holstein Friesien bulls from the Carnation Stock Farms, Seattle, U.S.A., was the subject recently of a question in the British House of Commons. The Secretary of State for India was asked if the purchase was on behalf of Captain Macguckin's department, to what part of the Empire the bulls were exported, and why the order was not placed in the British Empire. It is to be hoped that the member has been suitably enlightened regarding his questions.

Readers who will look over the four pages of advertising of the Carnation Milk Farms, appearing in this number, will realize that the purchase above referred to was surely made on one supreme consideration, namely, merit. The Government Military Dairies of Northern India, being in the need of the best Holstein Friesien stock that could be secured anywhere, would have made a serious mistake if it had not secured their stock from Carnation Milk Farms, the most outstanding breeders of Holstein Friesien stock in the U.S.A. A definite opportunity is now presented to the Military Dairy Farms, by means of the progeny test, to compare the relative merits of these recently-imported American bulls with bulls previously imported from Great Britain, Holland, and South Africa.

* * * *

The Bihar Earthquake and Building Construction

In this number our readers will find an article by Mr. A. T. Mosher, Agricultural Engineer, on the marginally-noted subject.

The success of the Secretariat building, Patna, in withstanding the shock of the recent earthquake, is a tribute to reinforced brickwork construction, of which we believe this building was the first of this type of construction in India. This type of building construction was introduced into the U.S.A. seven years ago by Mr. Mason Vaugh, Agricultural Engineer of the Allahabad Agricultural Institute, after making a scientific study of the various features of this type of reinforced brickwork construction.

Our readers, whether in the earthquake zone or not, who are contemplating building construction would be well advised to consult Mr. Vaugh, either through the Editor or directly.

* * * *

A New Method of Preparing Phosphoric Acid from phosphate rocks has just been perfected by an American Chemical Engineer, H. W. Easterwood. By this process, which is based upon the principle of the blast furnace, long used in the production of pig iron ores, Mr. Easterwood has been able to produce up to 250,000 pounds of phosphorous pentoxide per day in a newly-erected plant in Tennessee. The pentoxide is easily converted into phosphoric acid, which, in turn, can be changed into ammonium phosphate for use as a concentrated chemical fertilizer, or the acid can be used directly for new chemical industrial purposes. The chief advantage of the new method over methods used heretofore is the cheapness of the method and its adaptibility to large scale production. Up to the present time the manufacture of phosphoric acid has been carried out in electric furnaces. By overcoming many chemical and engineering difficulties the new method applies the old principle of the blast furnace, with consequent economic production of a much used chemical. This new discovery may have considerable influence on the phosphate fertilizer industry.

* * * *

Recent Nutritional Studies according to the Journal of the American Medical Association, indicate that *highly-coloured natural foods seem to possess unusually nutritive qualities.* The relationship between carotene and vitamin A has been pointed out and demonstrated by several investigators. Carotene is the substance which gives carrots their yellow colour and occurs in other plant materials, particularly such vegetable as the pimento pepper and tomato, and in many fruits. There is a growing tendency to associate vitamin potency with these more highly-coloured natural foods. This is further confirmed by the work of Ascham (Bull. Georgia Expt. Sta., No. 177, September, 1933), who has demonstrated that bright red vegetable, *the pimento pepper*, is a prominent source of vitamin A and that its potency is related to its carotene content. Other investigators have found a similar relationship in evaluating the nutritive value of some of the fruits. In this regard it is interesting to note the difference between plant and animal materials. In the former there seems to be the close relationship between the vitamin A potency and the carotene content, while in the latter this pigment seems to account for only a minor part of the vitamin A potency.

THE BIHAR EARTHQUAKE AND BUILDING CONSTRUCTION

[A. T. Mosher, B.Sc. Ag., Agricultural Engineering.]

That "the arch is dead" and that reinforced brickwork has justified its reputation for strength were the two outstanding observations of three members of the Agricultural Institute staff who visited Patna and Muzaffarpur to study the damage done to buildings by the recent earthquake of Northern Bihar. The party spent one day each in Patna and Muzaffarpur observing buildings, taking photographs of characteristic instances of damage, and consulting with resident engineers and owners of both damaged and comparatively undamaged buildings.

The failure of arches, both large and small, was so nearly universal that it could not be overlooked. In many instances the extra strain in the arch caused by the addition of a kinetic stress to the static stress, for which the arch has been designed, was more than the compression portions of the arch could stand and the bricks along the exposed face of the arch were crushed. In other cases the main body of the arch itself remained as one unit, but vertical or random cracks in the wall above tended to indicate that the horizontal thrust of the load carried by the arch had "spread" the arch until the supported wall had been ruptured. These two types of damage would seem to be indicated by the observed evidence. Whatever the technical cause it was very evident that arches stood the quake much less well than did either reinforced brick or concrete or even wooden lintels used in similar positions.

Reinforced concrete and brickwork (most of the reinforced construction in these two cities was brick) were less affected by the quake than any other type of construction. Two advantages seemed to follow from their use: units such as ceilings and roofs had almost no tendency to shatter, and the presence of reinforced work in the ceilings served to hold the walls more firmly and prevent them from breaking.

Many instances of the first advantage were found. In places where the roof had been of reinforced brick the walls had fallen away from beneath a corner of the roof, but the roof had remained unbroken with the unsupported corner still in position. At the Nurses' Home of the Government Hospital in Patna the front verandah wall supporting the reinforced floor of the second storey verandah and the reinforced roof had crumbled away. The reinforced work had not shattered, but had remained in one piece, folding down against the inside wall but remaining against the wall hanging by the reinforcing rods. At the Methodist Mission Girls' School in Muzaffarpur the pillars supporting a heavy rein-

forced brick lintel gave away, but the lintel itself fell in one piece and unbroken to the ground twelve feet below.

The second advantage of reinforced work was best illustrated by the difference in the damage done to the Secretariat and to the High Court buildings in Patna. Both buildings have wide verandahs around the outside. In the Secretariat building the ceilings of these verandahs are of reinforced brick, and here the damage was almost entirely limited to the shaking loose of plaster and to small cracks along the edges of the units of the ceiling. The outside walls of the verandah were practically undamaged.

In the High Court building, however, the ceilings of similar verandahs were of plaster put directly on to expanded metal nailed to wooden supports. Evidently this ceiling did very little in holding the walls together firmly, for the outside wall of the verandah was broken off just above the second storey floor almost entirely around the building. In some places the wall broke horizontally and may, perhaps, be repaired. Much of it, however, is broken at a downward angle of from 10 to 45 degrees, and is as much as 3½ inches out of plumb in a rise of 15 feet, making it very unsafe in its present condition and almost impossible of repair without entirely rebuilding the wall.

This effect of reinforced construction seems to be very important that a reinforced ceiling or roof tends to bind the walls together much more firmly and solidly than do other types of construction.

One of the most profitable construction studies of the earthquake results is observation of the places in the building which fail first, indicating where present construction methods are least adequate from the standpoint of earthquake protection. Two of these have already been mentioned—(1) Where the arch is used to support the building above an opening in the wall, the changes in the stresses on the arch due to shaking are most likely to lead to failure; and (2) where the ceilings are not such that they knit the walls firmly together at the top, especially in more than one-storey buildings, the outside walls are very likely to break off just above the second storey floor line.

Another outstanding point of weakness in most buildings from the standpoint of earthquake protection is the construction of vertical walls and of pillar supports. Time after time buildings were observed in which the horizontal members had stood the shaking until the vertical members had failed from beneath them. Walls are very seldom reinforced as horizontal members are. Buildings constructed on the assumption that the earth is going to remain stationary and that if a wall or pillar is capable of supporting a sufficient vertical static load that is all that is required. Conse-

quently when the earth does move it is setting up forces which the building is not designed to withstand. If buildings are to be protected from earthquake damage it will be necessary to reinforce the walls against lateral, intermittent motion as well as against a vertical, static load. This lesson has been learned in other regions which have experienced severe earthquake, and it is confirmed by the damage in Bihar.

The fourth point of weakness is the connections of wall to wall and of walls to ceilings. In most cases ceilings are laid on top of walls, but not joined securely to them. Again, the assumption is made that the walls are going to remain stationary. If ceilings were by reinforcement or by unit construction made interlacing and integral with the walls at the points of connection they would be much less likely to crack or fail.

The fifth common failure on many buildings is the failure of small decorative cupolas built with a fairly heavy roof supported by small pillars. The Council chamber at Patna was practically undamaged except for the four cupolas, one on each corner of the roof, and in each of these all of the supporting pillars were broken. The heavy mass of the roof evidently possessed sufficient inertia that when the quake came the pillars were unable to withstand the lateral strain. Indeed, this type of failure is the most conspicuous example of what would seem to be a rather general principle that the heavier the mass supported, the more the lateral strength necessary in the supporting members. It is very largely the inertia of the mass of the building that keeps the building from moving freely with the earth and that, therefore, is largely responsible for earthquake damage.

The damage in Patna was limited to the effects of the shaking action of the quake only. In some parts of Muzzaffarpur, however, actual fissures and both lateral and vertical displacements in the earth's surface occurred directly beneath buildings. In such cases quite different damage ensued. In one building, in particular, the entire two-storey building was split into two parts at the line at which a fissure occurred, and one part of the building was displaced about 11 inches laterally and 18 inches vertically. Under such circumstances it would seem to be too much to hope to prevent building damage, but even there the construction methods which will entirely prevent damage in less seriously shaken areas would serve to minimise the falling of loose material during the quake and its consequent danger to life. Under such conditions even well-constructed buildings would probably crack and become badly damaged, but could usually be expected to "hang together" much as shatter-proof glass, although badly cracked will remain in place.

The question of the economics of building to withstand earthquake damage is another problem. Into its consideration must come the probable or possible frequency of future earthquakes, the danger to life involved in a particular building, and the comparitive cost of building to withstand damage or of rebuilding if damage should occur. Some changes in construction could be effected with practically no extra cost. It would seem that the resident Government Engineer stationed in Patna was right when he remarked that "the arch is dead." Reinforced brick lintels replacing arches would materially strengthen the construction, and would cost practically the same. Possibly an economical method of tying elements of the building together and of strengthening vertical members such as walls against lateral stresses can be developed which would prove practicable even in a region in which earthquakes are seldom felt. It may be decided that public buildings, such as school houses and hospitals, at least must, regardless of the cost, be sufficiently protected. At least the present disaster has provided vivid evidence of the weak and strong points in present construction methods when considered from the standpoint of earthquake resistance.

(*Continued from page* 59).

average there is an increase of about 18·5 in the yield of cane as well as *rab*, as can be seen from the above tables. Not only the cane-growers will be profited to this extent, but at the same time wool industry will also get a helping hand, which means an additional profit to the sheep-rearing community.

Besides being useful to the sugarcane crop it is said to have its useful effect on the succeeding crops in that particular field.

References

1. Indian Year Book, 1932, p. 743.

2. Report, Whitley Commission on Labour in India—1933, p. 94.

Report Royal Commission on Agriculture in India, 1928.

4 and 5 mentioned with the tables.

From 10 to 20 lakhs of cattle are destroyed annually in India due to outbreaks of rinderpest. Any animal in India can now be guaranteed against rinderpest. Consult your local Veterinary Officer.

METHOD OF MILKING AND HIGH MILK YIELDS

[B. Orre]

There is profit in high yields—on conditions. It is not the high-producing animals which are responsible for the surplus and unremunerative prices of dairy produce, meat, etc., but the great mass of "boarders." If dairy farmers would cull the animals which do not produce enough to pay for the fodder, labour, housing, etc., necessary to maintain them, and keep only the higher-producing animals, then—and only then—can they expect to get adequately paid for their produce and labour.

As regards the method of milking many people maintain the opinion that the greater the adaptability to the individual requirements of the animal, the more conducive should the milking be to very high yields.

This seems very plausible. Outstanding animals, highly-bred and capable of extraordinarily large yields, are often nervous, capricious, and high-strung; it seemingly stands to reason that a skilled hand milker, having studied the individuality of each animal and adapting himself to it, should be able to turn this exceptional capacity of the animal to better advantage than a machine can be expected to do.

As regards the outstanding individuals, in order to turn their milk-producing capacity to proper advantage, the rations must be individual; it seems the milking should be so, too.

There is hardly any difference of opinion as regards the average animal with average milk yield. If the machine milks all animals always in the same regular cadence, just the cadence which has been found most suitable for the average cow, there is no reason why it should not be able to maintain the herd average yield on a high level.

Hand-milking—at least in theory and as far as skilled hand-milking is concerned—may be able to adapt itself to the individual requirements and peculiarities of each single animal. As regards mechanical milking, the individual must evidently adapt itself to the unvarying cadence of the machine. There is a certain power of adaptation inherent in every individual, animal as well as human, and the younger the individual the more pronounced it is likely to be. The uniform action of the machine is likely to bring about a certain levelling effect, calculated to prevent the development of peculiarities which are not inherent, *e.g.*, if a cow is hard-milked, it is often the result of rough treatment; if the machine can prevent the formation of such characteristics, it is, of course, all right. On the other hand, if the levelling effect extends also to such individual characteristics as exceptionally

high yields, it must evidently be considered a point in favour of the milking by hand.

But does it really? With the increased prominence of mechanical milking this question is worthy of consideration on the part of breeders, and so it may interest our readers to learn about the outcome of investigations in Denmark, extending over a number of years. The repute of Denmark as a dairying country is well known, and the result is remarkable, the more so as the record cows look rather like "scrub" cows.

The first one, owned by P. Holsmlund, Espe, Fyen, has always, ever since her first calving, been milked by machine. In 1930, at the age of seven years, according to the official test figures for the previous lactation period, she proved to have attained a production of 1,250lbs. of butter (22,970lbs. of milk with a fat content of 4·83 per cent.) which constituted the Danish record for the year.

The second cow, property of A. Peterson, Pilegaard, Kogsbolle, produced about the same time, *viz.*, in the course of her second period of lactation, 17th November, 1929, to 2nd October, 1930, 518 lbs. of butter (9,872lbs. of milk with a fat percentage of 4·64). She was then hand-milked, whereas at the beginning of the next period of lactation machine-milking was started. The result from this period, 2nd October, 1930, to 3rd October, 1931, attained 1,063 lbs. of butter (18,060lbs. of milk with a fat percentage of 5·21), which was the second best result in Denmark this year. Next period of lactation, 3rd October, 1931, to 27th October, 1932, the production attained 1,261lbs. of butter (18,547lbs. of milk with a fat content of 6 per cent.), doubtlessly the very best result ever attained in Denmark.

And the progeny of this cow bids fair to do even better. Already a daughter, in the course of her second period of lactation, has produced 781 lbs. of butter (machine), whereas the dam, as mentioned above, in the course of the corresponding period produced but 518lbs. (hand).

At present in India there are about 18 Indian-owned cigarette factories, with 26 cigarette-making machines, and turning out about 10 lakhs of cigarettes per day.

Local Governments should take forceful steps to enforce and extend the existing laws concerning the destruction of stray and ownerless dogs!

ECONOMIC USE OF THE WASTE-PRODUCTS OF WOOL INDUSTRY

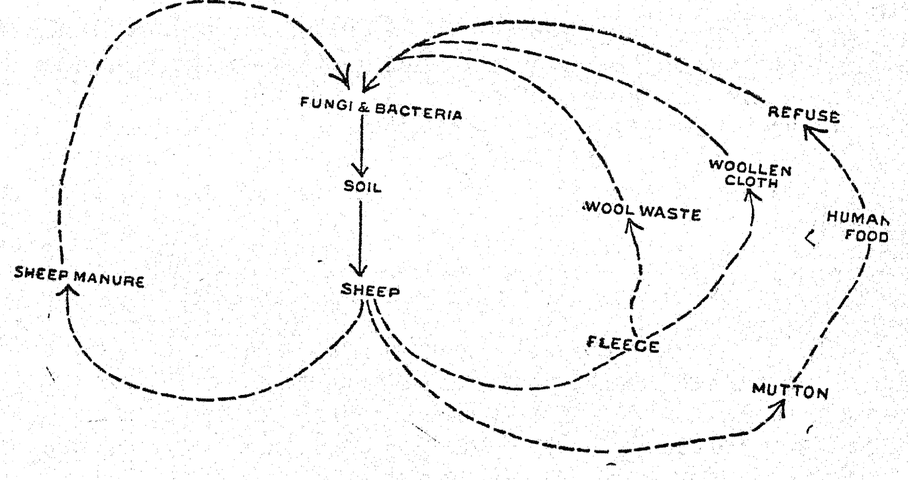
[By B. S. Nigam, L. Ag., B. Sc. (Agric.)]

Importance of Wool Industry

Wool industry in India is of considerable importance. There are more than half-a-dozen mills working in India. These mills consume most of the wool produced in India, which is estimated at about 60 million pounds. (1) Sheep-rearing is more or less done by a class of people called Gadarias, and they are chiefly kept for mutton, and the fleece has generally been regarded as of subsidiary interest.

Necessity of the Economic Use of the Waste-products.

Success of an industry depends on the economic utilisation of bye and waste-products for the purposes of further production. Nature moves everything in cyclic order. Sheep are fed and they produce fleece, which is used for cloth-making, and some of it goes as waste. They must find their way back to the field. The cycle is diagramatically represented thus:—



The elements removed from the soil by the way of agricultural crops are returned to it in a more complex form. They require the splitting up into simpler substances before they can be of some use to the crop. This process is universally essential no matter in what form the soil produce has been exploited by man. This is done in the factories of nature in the soil by a variety of fungi and bacteria. Thus fungi and bacteria are the indispensable link in the cycle of Nature. Looking to the importance of these minute organisms one is inclined to treat them with the highest value in regard to humanity.

" Wool-waste is the bye-product of the cleaning process, which is done on a factory scale in the Punjab and one or two other provinces. This initial process consists of tearing or beating out with hand or iron rods lumps of dry mud, coagulated blood, and other extraneous matter from the unsorted wool, which is subjected to further grading." (2) Thus discarded wool along with all the dirt is called wool-waste. This can and has economically been used as a manure

Necessity of Manuring

Soil supplies all the plant requirements in a small quantity, and an additional supply of plant food in the form of manure has universally been found to have a beneficial effect on the crop, the yield of which is considerably increased as a consequence of manuring. Thus in order to maintain the balance of plant food in the soil it is absolutely necessary to apply manures regularly.

"On the whole, Indian soils are deficient in nitrogen, which is by far the most important of all the principal plant requirements. The manurial problem of India is, in the main, of the nitrogen deficiency, which alone is responsible for the poor yield of agricultural crops. India, as is well known, depends almost exclusively on the recuperative effects of natural processes in the soil to restore the amount of nitrogen, annually removed by the agricultural crops, for only a small fraction of it returned to the soil. Much of the farmyard manure is burnt as fuel, while a large quantity of nitrogen is exported in form of oilseeds, food, and other grain."

Wool-waste as a Manure for Sugarcane

(3) Wool-waste contains about 0·8 per cent. nitrogen, while the dung manure has only 0·5 per cent. Thus the former is a richer manure than the latter. A huge amount of the Indian stock of nitrogen is locked up in wool-waste, which can be exploited for the farmers as well as the wool industry.

Commercially, sugarcane is one of the most important agricultural crops, and it pays the growers to apply costly manures. Experiments on the use of wool-waste as a manure have been carred out in the United Provinces by the Agriculture Department at the Cawnpore Experimental Farm. The experiment lasted for three years from 1927-28 to 1929-30. The experiments were instituted to ascertain under what conditions the best results could be obtained from the use of this substance as manure for sugarcane. Wool-waste was applied in the field in trenches. Both rotted (rotted previously in pits) and fresh wool-waste were

applied with a view to find out their comparative value. It was applied at the rate of 100lbs. of nitrogen per acre. The Coimbatore 213 variety was sown. The results obtained in 1929-30 were identical and they were :—

1929

Treatment	Outturn in lbs per acre			Percentage		
	Stripped cane	Juice	*Rab*	Juice/Cane	*Rab*/Cane	*Rab*/Juice
Rotted wool-waste applied in December,	59,700	37,560	6,751	62·91	11·31	17·97
Fresh wool-waste applied in December and watered immediately	65,470	43,015	7,443	65·7	11·37	17·3
Fresh wool-waste applied in December and not watered ..	64,670	42,910	6,963	66·35	10·76	17·27
Control Plot ..	53,658	39.941	6,283	65·11	11·71	17·98

4. (Report of Department of Agriculture, United Provinces, Central Circle, 1928-29.)

1930

Treatment	Outturn in lbs. per acre			Percentage		
	Stripped cane	Juice	*Rab*	Juice Cane	*Rab*/Cane	*Rab*/Cane
Rotted wool-waste applied in December,	70,620	47,300	7,830	67·0	11·1	16·6
Fresh wool-waste applied in December and watered immediately . ..	78,730	52,94)	8,843	67·2	11·2	16·7
Fresh wool-waste applied in December and not watered ..	72,550	49,320	8,043	68·0	11·1	16·3
Control Plot .	68,730	45,950	7,680	66 9	11·2	16·7

4. (Report of Agricultural Stations, Central Circle, U. P. Department of Agriculture, 1929-30—p. 5).

In both the years wool-waste watered immediately after application has given the best results. Taking the two years'

(*Continued on page* 54).

CROP MANAGEMENT

[By S C. CHOWDHURY.]

THE fundamental problem in agriculture to-day is how to organise a farm business so that it will be profitable and otherwise satisfactory. The best farmer is not the one who knows the most "science," but the one who is best able to organise the facts and the business into a harmonious system or plan. The principles that underlie such organisations are now beginning to be apprehended, and we think we see the possibilities of a sound farm philosophy, with wise generalisations from the mass of rapidly accumulating facts and practices. The basis of farm organisation is crop management, maintenance of fertility and consequently of productiveness, the subsistence of live-stock, the economy of labour, and the type of business. Crop management must, therefore, be considered in some detail.

I—CROP ROTATION

The term "rotation of crop" means that the crops grown on each field are changed from time to time in a fairly regular way. Its purpose is primarily to increase the yield of the various crops by conserving the fertility of the soil and eliminating weeds, pests, and diseases. Practically every farmer does change crops occasionally on at least part of his farm, but it is very often imperfect and ill-planned. In most parts of the country it is common practice te have maize follow wheat and wheat follow *juar* or maize. Such indefinite practices are, perhaps to be called modes or systems of cropping rather than crop rotation. Crop rotation is a more purposeful and orderly procedure.

Why Rotations are Useful.—There is no dispute as to the value of rotation of crops. The only difference of opinion are in respect to its feasibility in particular cases and the merits and demerits of the different courses.

One of the early explanations of the good results of rotation of crops is the doctrine that some plants exhaust the soil of certain materials which are not needed by other plants; therefore the value of rotation depended on securing such a combination of plants or crops as would in time utilise all the elements of the soil. There is, of course, some truth in this teaching, but we know now that the question is by no means one of so-called exhaustion alone.

Another early explanation is found in the theory that roots of plants excrete certain substances that are noxious to the plants. excreting them and innocuous, even beneficial to other plants This theory was taught early by the renowned Swiss botanist,

Pyramus de Candolle. This is, no doubt, a suggestion from the animal kingdom. Fortunately it has been given up now.

Some of the reasons why rotation in farming is advocated in this scientific age can be grouped up in the following lines:—

1. Crop rotation helps to control weeds, insects, and diseases. Nearly every crop is accompanied by certain weeds that are able to grow with it, but that do not bother other crops. There are many diseases that injure one crop, but that are not harmful to some other crop. The same principle holds for insects and pests.

2. Crop rotation may provide for keeping up the humus supply of the soil. If crops are not rotated the fields that are constantly intertilled will soon have their humus supply seriously decreased.

4. By a judicious choice of crops different plant food materials may be incorporated in the soil in available condition through the decay of the parts of ploughed under or left in the ground.

4. Some plants have the power more than others to utilise the content of the subsoil.

5. Well-considered rotations reduce the necessity of excessive use of commercial fertilizers.

6. Labour is often saved by crop rotation. In some parts of the country winter wheat is sown after early potatoes or beans, so that one ploughing of the soil does for wheat.

7. By crop rotation the land may be occupied with crops a greater part of the time.

8. Deep and shallow-rooted plants may be alternated, thus making use of the deeper soil.

9. Rotation-farming develops a continuous and consecutive plan of business.

Characteristics of a Good Rotation.—In order to maintain soil fertility, and at the same time to make the greatest profit in farming, a practicable and scientific rotation of crop may include the following under normal conditions :—

1. Grasses and perennial legumes.

2. Pasture, with an addition of manure, one or two years previous to breaking the "sod."

3. Intertilled crops.

4. Small grain crops, with green manuring crops planted in the "stubble" after harvest.

For a self-sustaining farm small grain crops must be grown, often they are the greatest money-making crops; hence they must be given a prominent place in the general crop rotation system. Intertilled crops are often the money-making items of the farm

also, and they are useful in a rotation system in order that the land may be cleared of weeds. Especially is this true in a locality where small grain is the main crop. Cultivation also conserves the soil moisture and develops the fertility of the soil.

Pasture is desirable on every farm carrying live-stock, and it is essential that it be made part of the regular crop rotation. Many soils become too light and mellow by continuous cropping and need the trampling of stock to firm them. Much more grass can be produced on tillable lands when the pastures are kept fresh and new, and the increase of fertility and improvement of soil texture results in larger crops of corn and grains when the meadow or pasture is broken and planted again to these crops.

A convenient and desirable time to manure land is while it is being used as a meadow of pasture. If the manure is applied a year or so before breaking it will stimulate the growth of grass and cause a greater production of hay and pasture. Meanwhile the soil is enriched by an increased root-growth and the formation of more humus.

Crop Rotation in India.—The rotation of crops is well understood and is generally practiced with a more or less definite system. Voelcker states that the same fields have grown the same crops on much the same system as at persent. For centuries, it is averred, too, that by rotation and fallows the land receives the necessary change of cropping, and the "rest" from cultivation which prevents its going down in quality. A remarkable feature is the frequent use of legumes and the sowing of mixtures of crops together, the same to be harvested at different times.

Rotation in Bengal.

(1) Main Crop Sugarcane.

Four crops in two years. Preparation. Jungle cleared in March to May and sown to ans paddy or maize which is harvested in September; then potatoes—(*a*) Potatoes, harvested in February and sugarcane planted; (*b*) sugarcane, harvested in February and followed by either cowpeas, dhaincha (sesbania aculeata) sunn-hemp (Crotalaria juncea), to be succeeded by potatoes, gram or pulse, preferably kurthi (Dolichos biflorus).

(2) High and Light Soils.

Nice crops in five years—(*a*) Ans paddy (May to September), followed by a pulse or oilseed crop, or the two mixed together (October to March); (*b*) jute (April to September), followed by a pulse or oilseed crop or the two mixed together (October to March);

(*c*) ans paddy (May to September, followed by potatoes October to February); (*d*) sugarcane (February to September); (*e*) ans paddy (May to September), followed by a pulse crop (October to March).

(3) Low and Light Soils.

Eight crops in five years—(*a*) Maize sown in April, til (Sesum indicum) and barley, sown in September; (*b*) sugarcane, sown in February; (*c*) sunn-hemp and jute, sown in March, and mustard and country peas sown in October; (*d*) aman paddy, sown in June; (*e*) cucurbitaceous catch-crop sown in January and aman paddy, sown in June.

(4) High and Heavy Lands.

Eight crops in six years—(*a*) Sugarcane, sown January to February; (*b*) buhri cotton (if virgin soil) or (if old tilth) arhar, sown in May; (*c*) jute, sown in April, linseed and gram sown in October; (*d*) maize, sown in April, linseed or Kalai (Phaseohis mungo), sown in October; (*e*) ans paddy, sown in May; cowpeas, sown in September; (*f*) fallow, also used as a cattle run, on which the cattle graze.

(5) Low and Heavy Soils.

Six crops in five years—(*a*) Aman paddy, sown in June and a cucivebitaceous catch-crop, sown in January; (*b*) aman paddy, sown in June; (*c*) jute, sown in March, Kalai, musuri or lentils (Ervum lens), Khesari (Lathyrus sativus), and linseed in October; (*d*) aman paddy or a sugarcane that can withstand water; (*e*) follow.

Rotation in the Punjab.—Three crops a year: wheat or barley harvested in March, followed by melons, harvested and land fitted by July and sown to maize.

(1) 4-course, with sugarcane—(*a*) Dhaincha, sunn-hemp or cowpea cut when in bloom (August), and potatoes, planted in October; (*b*) potatoes, harvested in February and sugarcane planted; (*c*) sugarcane, harvested in February, and lands sown to arhar or ans paddy and then to potatoes; (*d*) potatoes harvested and sugarcane planted.

(2) 4-course on dry land—Two years fallow, two of crops—(*a*) fallow; (*b*) wheat and gram; (*c*) fodder juar (sorghum vulgare) (*d*) fallow.

(3) 5-course on rich land—(*a*) Cotton; (*b*) senji; (*c*) sugarcane; (*d*) maize; (*e*) wheat.

(4) 4-Course—(*a*) Wheat or barley with gram and oil-seeds; (*b*) juar or bajra with pulses; (*c*) fallow; (*d*) fallow.

Rotation in Bombay.

(1) Gujarat—(*a*) Cotton; (*b*) wheat or juar; (*c*) gram or other legume.

(2) Mahim—(*a*) and (*b*) betel vine (Piper Betel); (*c*) ginger (zingiber officinale); (*d*) sugarcane; (*e*) and (*f*) plantain (Musa sapientum); (*g*) rice.

(3) Surat—(*a*) Sunn-hemp, ploughed in followed by sugarcane; (*b*) sugarcane; (*c*) rice with arhar or other legumes; (*d*) legume.

Rotation in the United Provinces.

(1) 4-course—(*a*) Millet; (*b*) fallow or green crop ploughed in; (c) wheat or other winter cereal; (*d*) millet.

(2) 2-course—(*a*) Maize, with carrots between the rows; (*b*) if rainfall is heavy, gram, mustard, or safflower.

(3) 2-course—(*a*) Maize with carrots; (*b*) wheat or barley.

Agra Division.

(1) 2-course—(*a*) Cotton; (*b*) wheat.

(2) 1-course—(*a*) Cuar; (*b*) barley.

(3) 2-course—(*a*) Bajra, gram; (*b*) fallow; wheat.

Meerut Division.

(1) 3-course—(*a*) Cotton; (*b*) sugarcane; (*c*) wheat.

(2) 2-course—(*a*) Bajra; safflower; (*b*) fallow and wheat.

(3) 2-course—(*a*) Cotton; pea; (*b*) wheat.

Rohilkand Division.

(1) 3-course—(*a*) Cotton; (*b*) sugarcane; (*c*) wheat.

(2) 2-course—(*a*) Maize, gram ; (*b*) fallow ; barley.

(3) 3-course—(*a*) Cotton ; (*b*) tobacco ; (*c*) fallow wheat.

Rotation in Central Provinces.

(1) 3-course—(*a*) Cotton ; (*b*) oilseed ; (*c*) Kodo millet Paspalum scorbicutatum).

(2) 6-course—(*a*) Maize or millet ; (*b*) wheat ; (*c*) wheat; (*d*) wheat ; (*e*) legume ; (*f*) legume.

Rotation—An Economical Farm Practice.—Many experiments have reinforced common experience as to the importance of rotation, particularly in recuperating farm lands. Experiments made at Rothamsted are, perhaps, the most conclusive, because of the long period. Wheat has been grown without rot-

ation for sixty-six years and other crops for varying periods. No method of fertilising potatoes or clover kept up the yield without rotation. Rotation alone did not fully maintain the yield of any crop, but the combination of manure or fertilisers, with rotation increased it. At the Louisania Experiment Station it was found, as a result of eleven years' work, with a three-course rotation (first-year corn, second-year oats followed by cowpeas, third-year cotton) that the yield increased from 12 to 25 per cent. even without the application of manure. In another part of the same experiment manure was applied, and the general increase in yield was 400 to 500 per cent. This shows that a plain rotation is itself capable of increasing yield, but a greater increase is to be expected by a combination of rotation and manuring.

II.—Cropping Scheme.

The principles on which cropping schemes are based are very similar to those underlying scientific rotation of crops " with this difference that while a rotation of crops aims at economy of plant food, indirectly by virtue of the peculiar characteristics of each variety of crop grown, cropping scheme provides in addition an economic use for all valuable manures, water, labour, machinery, and, in fact, all the material resources available, which the farmer controls."

Planning the Scheme.—Just what cropping scheme shall be adopted in any case must depend on many local and special considerations. The following are some of the considerations that should be considered in planning any scheme of cropping :—

(1) The cropping scheme must adapt itself to the farmer's business—to the support of live-stock if he is a dairyman or stock-owner, to the demands of the grain trade if he is a grain farmer to the cotton market if he is in the cotton districts.

(2) It must adapt itself to the soil and fertility problem. Often the chief purpose of drawing a cropping scheme is to recuperate worn-out and depleted lands.

(3) The fertiliser question often modifies the cropping scheme—whether manure can be purchased chiefly and in abundance, or whether it must be made on the farm.

(4) The kind of soil and the climate may dictate the cropping scheme.

(5) The labour supply has an important bearing on the character of the cropping scheme. The farmer must be careful to plan to keep the number of ploughings and the amount of cultivation within the limits of his capabilities.

(6) The cropping scheme must be planned with reference to the species of plants that will best serve one another, or produce the best inter-relationship results.

(7) The cropping scheme must consider in what condition one crop leaves the soil for a succeeding crop.

Drawing up the Scheme.—The first step necessary in drawing up any cropping scheme is to make a list of all the farmers' resources which are available for crop production and marketing. The following are some of the headings under which his resources may be grouped:—

(1) *The Soil.*—Its character—physical, chemical and biological and suitability for the growth of different crops with the greatest return.

(2) *Capital.*—Capital available to the farmer for such necessary expenditure as labour, seed, manure, bullocks, implements, water, etc.

(3) *Manure.*—The kind and quantity of manure available.

(4) *Labour.*—The quality and the quantity of labourers available to serve as farm servants throughout the year.

(5) Marketing facilities.

(6) Storage facilities for the farm produce.

(7) Available motive power, bullocks, tractors, etc.

"Along with the above should be drawn up a list of all possible crops which may be grown with reasonable hope of profit in that particular locality, and lastly the market both proximate and distant must be carefully studied with a view to determine that ultimate demand value of each type of farm produce.

"Having tabulated the above valuable data the next step in drawing up a cropping scheme is to divide the farm on the map into a number of divisions of convenient size, say, 5 acres each. This may be done on the map, the object being to facilitate the work of drawing up a cropping scheme by breaking the farm up into small units.

"Next take any one unit and jot down for each field the crop or crops which, with the information already carefully recorded, seem the most obviously profitable."

In order to demonstrate the working of practical systems of cropping scheme, as outlined, assume for illustration a farm of 30 acres, divided into six equal fields of five acres each as shown in the following diagram:—

(*Continued on page* 69)

FRUIT PRESERVATION.

[By A. D. Chand.]

Papaya Preserve.

Papaya	...	5lbs.
Sugar	...	5lbs.

Process.—Take half-matured, large and fleshy papayas. Peel them carefully and cut them lengthwise into inch-wide slices. Core out the seeds and clean the fibre from inside nicely. Cut the slices two or three inches in length and make about ten incisions on each piece and soak them in salt water for about two hours.

Meanwhile prepare syrup of five pounds of sugar and four pounds of water over a slow fire, and, when the syrup becomes a little thicker, remove it from the fire; cool it and add papaya slices into it, after washing them twice with fresh water. Put them on fire and continue cooking on a fairly slow fire, until the syrup reaches the desirable consistency. Remove it from the fire, and after cooling transfer it to wide-mouth bottles and close them air-tight.

Pumpkin Preserve.

Pumpkin	...	4lbs.	Cardamom minor	...	1 oz.
Sugar	...	4lbs.	Rose water	...	2 oz.
Rice flour	...	½lb.	Alum	...	2 oz.

Process.—Take white variety of pumpkin, which should be at least a year old. Peel off the skin and cut lengthwise into inch-wide slices and clean the fibre. Make incisions all over with a fork and cut the slices into cubes. Soak them in lime water for an hour and then boil them in a solution of rice flour and alum, until the pieces become soft and tender. Remove them from the fire and immediately transfer them in cold water, rinse them thoroughly; drain off the water and shake off the adhering water.

Prepare a thin syrup of four pounds of sugar and three pounds of water, and while boiling add the prepared slices; cook them over a slow fire unless the syrup becomes pretty thick.

When ready add powdered cardamom and rose water; remove it from the fire and cool it immediately. Seal the product in wide-mouthed glass jars.

It makes an excellent preserve, and is said to be a very good cure for patients suffering from bilious disorders.

Water-melon Preserve.

Water-melon pulp ...	4lbs.	Cardamom ...	1 ounce
Sugar ...	4lbs.	Alum ...	2 ounces
Rice-flour ...	¾lb.	Rose-water ...	2 ”

Process.—Select a well-matured water-melon. Eat the red pulp and peel off the outer green skin. Cut the slices either in cubes or two or three inches in length and one inch in breath. Make incisions all over with a fork and proceed like pumpkin preserve.

Sarda Pickle.

Sarda pulp ...	4lbs.
Sugar ...	4lbs.

Process.—Take nearly ripe sardas, peel off the skin carefully, and clean out the seeds and fibrous matter from inside. Cut them in cubes and make incisions all over the pieces with fork and allow them to soak in cold water for an hour and then pour them in a sieve to drain off all the adhering water.

Prepare syrup of 4 pounds sugar and 3 pounds of water, and, while boiling, introduce sarda slices and cook them over a gentle fire, removing the scum as it appears, until the syrup is quite thickened. Remove from the fire and bottle when cool.

Carrot Preserve.

Carrot ...	4lbs.
Sugar ...	4lbs.

Process.—Take yellow, smooth, English variety of carrots. Scrape off the skin and hair; and cut them into halves. Soak them in cold water for about two hours. Remove them from the water; make incisions all over with a fork and boil them in fresh water until quite soft. Ladle them out in a sieve for draining the adhering water.

Get the syrup prepared using four pounds of sugar and three pounds of water. While the syrup is still thin introduce the carrots and allow them to simmer over a gentle fire. Remove the scum as it appears and stir it occasionally but gently. When the syrup becomes fairly thick remove it from the fire; cool it soon after and bottle.

Ginger Preserve.

Ginger ...	2lbs.
Sugar ...	2lbs.
Lime ...	10 ounces
Cardamom minor ...	2 ”
Rose water ...	2 ”
Blackberry leaves ...	10 ”

Process.—Obtain fresh, good sound ginger; neither too old nor over-ripe, otherwise the preserve will deteriorate and get spoilt.

Cut the ginger in pieces and pare off the skin. Make incisions all over with a fork. Soak the ginger in lime solution and wash it with fresh water for several times. Dissolve 10 ounces of pounded blackberry leaves in about 3 pounds of water and boil the ginger in this solution for a little while. Take out the ginger and wash it in fresh water for five or six times.

Now get ready thin syrup, adding adequate amount of water in two pounds of sugar and when boiling; introduce ginger in it. Allow it to simmer slowly over a slow fire, stirring it as required. Continue cooking unless the syrup assumes the consistency of honey.

Finally remove it from the fire; add rose water and powdered cardamom minor and bottle when it gets cooled.

Orange Preserve.

Orange pulp	...	4lbs.
Sugar	...	4lbs.

Process.—Select sound and unblemished oranges. Peel off the skin and remove all the fibrous matter from the cell without bruising them. Soak the cells in salt water for four hours, and then take them out and wash them in fresh water four or five times.

Get the syrup ready using 3 pounds sugar and 3 pounds of water; cool it and pour it over the prepared orange pulp and set it aside for 24 hours. Draw off the syrup; re-boil it, and after cooling pour it over the pulp. This time keep it for two days. After two days drain off the syrup again, cook it to the consistency of honey and pour it over the fruit. Keep the fruit well immersed under the syrup. This makes a delicious preserve.

(*To be continued.*)

(*Continued from page* 66)

CROPPING SCHEME.

Showing crops on all fields for one year.

Legumes and fodder ..	Wheat and fodder.
Wheat and hot weather vegetables ..	Pasture.
Juar and tobacco ..	Sugar-cane.

PROBLEMS OF NUTRITION IN INDIA*

[By Col. R. McCarrison, C.I.E., M.D., D.Sc., LL.D.,
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Throughout the whole of India the staple article of diet of the masses is a cereal grain of one kind or another—wheat, barley, millet, maize, and rice—sometimes a mixture of two or more of them. Most of these grains are eaten whole; these are not subjected to any milling or refining process before use. The outer layers of the grain and embryo, containing valuable dietary constituents, are thus consumed with endosperm. Rice is the single exception to this rule; though within recent years the use of white flour and white bread is spreading in the larger towns and cities. Rice is always subjected to some form of refining process. In country districts, distant from rice mills, it is pounded by the villagers in large mortars, a process which removes some, but not all of the external layers. In towns it is milled and polished in the raw state or after parboiling or curing. As is well known these processes reduce its nutritive value to a greater or a lesser degree. Biological tests in this laboratory have shown that these cereals differ in nutritive value, whole wheat being the most, and whole rice the least, nutritious. The other cereals occupy an intermediate position between these two extremes. All are deficient in certain food essentials—suitable proteins, calcium, sodium, iron, phosphorus, and certain vitamins. These deficiencies are greatest in whole rice; and, as rice is always subjected to refining processes, always washed before cooking, and always consumed after prolonged boiling, this cereal is, generally speaking, of much lower nutritive value than any of the others.

The nutritive value of some of these cereals may, and often does, vary in different localities; amongst rices grown in different parts of India this variation may be considerable; the same is true of millets. Thus certain millets grown in the south of India have been found to be surprisingly low in vitamin B, an observation which has a bearing on the not infrequent occurrence of beri-beri in millet-eaters resident in endemic areas of this disease. It has been found, too, that groundnuts and split peas (*dal*) grown in certain localities in South India are unexpectedly low in this factor. Observations of this kind have led to the suspicion that the nutritive value of certain cereal grains, legumes and nuts, in common use in India, may depend to some extent on conditions of soil, manure, and irrigation under which they are grown. A considerable amount of evidence in support of this supposition has been obtained in this laboratory. Thus it seems certain that

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rice grown under conditions of natural rainfall or of watering designed to stimulate natural rainfall contains more vitamin B than the same rice when grown in standing water. The former practice is generally followed in the south-west of India, where beri-beri is not endemic; the latter in the south-east where it is. Biological tests appear also to indicate that manurial conditions influence the nutritive value of cereal grains; and it seems likely that the almost universal practice of utilizing cow-dung for fuel purposes instead of returning it as manure, to the soil, is one that has a bearing on the nutritive value of Indian food crops. Thus agricultural practice appears to have a definite relation to problems of nutrition in this country.

To varied conditions of climate, rainfall, irrigation, and soil prevailing throughout the Indian Peninsula makes some part of it more suited to the cultivation of one cereal than of another. The cereal or cereals grown in any particular locality are those that enter into the dietaries of the inhabitants of that locality. In the North of India, North-West Frontier Province, the Punjab, Baluchistan, and the United Provinces wheat is the principal cereal grown; though some rice, barley, maize or millet are also grown. Generally speaking, the races resident in these areas—Pathans, (Afridis, Waziris, Bajauris), Punjabis, Sikhs, Baluchis, Rajputs, and Paharis—are wheat-eaters. Wheat is the staple article of their dietaries, the other cereals mentioned being merely adjuncts to it. A large amount of wheat is also grown in parts of Central India, Bombay, and the Deccan; but in general the races resident in these localities, such as the Mahrattas, use a diet of mixed cereals, usually wheat and rice. Towards the East, through Bihar to the coast of Bengal, all down the east and west coasts and throughout the Madras Presidency rice is the principal cereal grown; though in parts of these regions millet is also a considerable crop. But, for the most part, the races resident in these areas are rice-eaters. Throughout the rest of India millet is the chief crop, that forms the staple article of diet of races, such as the Kanarese, resident therein, who commonly use rice as supplement to it. In parts of Travancore the staple article of diet is the tapioca root supplemented with rice.

As we pass from the north to the east, south-east, south-west and south of India there is thus a gradual fall in the nutritive value of food-grains forming the staples of the national diets, this fall reaching its lowest limit among the rice eaters of the east and south. There is also a gradual fall in the amount of animal protein, animal fats, and vitamins entering into these diets. The races of the north are either milk users or meat eaters or both; while those of the south and east use both meat and milk sparingly and sometimes not at all. Thus the Pathans are meat

eaters; the flesh and fat of goats and sheep forming a principal constituent of their dietaries. They also use milk freely, chiefly in the form of butter-milk, curds, and butter and ghee. The Sikhs are large users of milk and the products of milk, milk being only an occasional addition to their diet. The Mahrattas also make free use of milk and milk-products, an additional source of animal protein being eggs and fish. The Bengalis, Kanarese, and Madrassis, on the other hand, are for the most part vegetarians; and, although some of them do eat mutton or fish, millions do not; while milk and milk-products are, in general, less extensively used by them than by northern races. It so happens, therefore, that as the nutritive values of cereal grains diminish there is also a dimunition in the amount of animal protein ingested and in the level of protein metabolism attained by the races concerned. There is, too, a precipitate fall in the amounts of vitamins A and B ingested by the races of the south, as compared with those of the north. Legumes (*dal*), vegetables, and fruit enter into all the national dietaries of India; but it is only among the better classes that a sufficiency of these is eaten. Accompanying the gradual fall in the nutritive values of the national diets there is a gradual decline in the stature, body weight, stamina, and efficiency of the people. McCay was the first to draw pointed attention to this association, which my own observations have confirmed. In his book—"The Protein Element in Nutrition" (1912)—he emphasizes the "all-important influence exerted by food, and particularly protein in determining the degree of muscular development, the general physical endowment, the power of endurance and resistance to disease, and the most important of all the place a tribe or race has won for itself in manliness, courage, and soldierly instincts." Indeed, nothing could be more striking than the contrast between the manly, stalwart and resolute races of the north—the Pathans, Baluchis, Sikhs, Punjabis, Rajputs, and Mahrattas—and the poorly-developed, toneless and supine peoples of the east and south; Bengalis, Madrassis, Kanarese, and Travancorians. McCay's work was done before the days of vitamins; and while he rightly emphasized the important part played by the protein element of food in bringing about this result we now know that other factors—vitamin and mineral elements—are concerned in it also. Inherited factors, climate, customs, caste, religion, and endemic diseases, no doubt, contribute their share to the production of this result; but food is the paramount factor concerned. This is shown to be so by an experiment carried out some years ago (1926) in this laboratory. Groups of young rats—20 in each—were fed on certain national diets of India, care being taken to stimulate in every detail the culinary practices of the races concerned. The animals were obtained from the same stock, an unusually healthy one. The experiment was

so conducted that factors such as climate, atmospheric temperature, rainfall, age, body weight, sex distribution, caging, housing, and hygiene were the same in all groups. It was found that the nutritive values of these diets—as determined by the average body weight of each group at the conclusion of the experiment—ranged themselves in the following order:—

Died				Average Body-weight of Group
Sikh	...	...	...	235 grams.
Pathan	...	...	...	230 „
Mahratta	...	...	...	225 „
Kanarese	...	...	...	185 „
Bengali	...	...	...	180 „
Madrassi	...	...	...	155 „

The "Sikh Diet"—the most nutritious of those examined—was made up of freshly ground whole wheat made into cakes of unleavened bread (*chapattis*), milk and products of milk—butter, ghee, curds, butter milk—dhal (legume), vegetables (fresh carrots and cabbage), tomatoes, root vegetables, fresh meat with bone and fat once a week and water. The "Madrassi diet"—the least nutritious of those examined—was made up of washed polished rice, dhal (legume), fresh vegetables, condiments, vegetable oil, coffee with sugar and a little milk, a little butter milk, ghee (sparingly), cocoanut, betel nut, and water. The respects in which these two diets differ are obvious.

Further evidence of the health-giving properties of the Sikh diet is afforded by the following experience—my stock rats are fed on this diet. The average daily strength of these is round about 1,000; sometimes more, sometimes less. The animals live under conditions of perfect hygiene and are exposed daily to sun's rays. During the past three years there has been no case of illness amongst them, no death from natural causes (the older animals are killed off when no longer of use for breeding purposes), and no infantile mortality other than an occasional accidental death. Large numbers of them (1,189) at all ages up to two years have been killed and subjected to *post-mortem* examination without revealing any microscopical evidence of disease except an occasional cyst (tapeworm) in the liver. Disease has been almost completely excluded by attention to three things—cleanliness, comfort, and food. These experiences illustrate the great importance of food in relation to the physical efficiency and well-being of animals and man; the importance also of a proper balance of the national diets of India with respect to animal protein, animal fat, vitamins and mineral elements; and the great value, as a health promoting agency, of

the lacto-vegetarian diet used by the people of North India amongst whom are some of the finest physical specimens of mankind.

Our first problem of nutrition in India—"What diet is most likely to maintain physical efficiency and health" has thus been solved. It is a diet composed of any whole cereal grain or a mixture of cereal grains, milk, the products of milk-butter, curds and butter milk-legumes, green leafy vegetables, root vegetables, fruit and water with meat occasionally. I notice that "Oslo Breakfast," which is reputed to be having such remarkable beneficial effects in Norwegian children, is of this order. To the tribes of our Indian frontier this is "an old accustomed feast."

One further fact in regard to the national diet of India is here deserving of note—it introduces another element into the complexities surrounding problems of nutrition in this country—that of high atmospheric temperature and drought. It was observed in this laboratory, about ten years ago, that the milk of cows subsisting on the pasture available during the hot months of the year contained less vitamin A than that of cows feeding on the green pasture that spring up after the rains. Generally speaking, it is safe to say that the vitamin content of the milk of the ill-fed and often semi-starved Indian cow is relatively low; a circumstance which is not without its effect on the well-being of the people into whose dietaries milk and milk-products enter.

It is not to be supposed that the national diets of India are invariably used in their completest form by every member of the races concerned. It is only those in better class circumstances who can afford to do so. The poorer classes, according to the degree of their poverty, drop out, in part or in whole, the more expensive or less easily obtainable items; meat, milk, milk-products, animal fats, legumes, fruits, and vegetables. So that as the people are poorer their dietaries are more and more cereal in character, more and more unbalanced, more aud more depleted of animal protein, animal fats, vitamins, and essential mineral elements. Lower down the social scale a stage may be reached when the diet consists mostly of cereal, and lower still it may not provide even enough of these; under nutrition is then added to faulty nutrition—a state in which millions of Indian people exist for the greater part of every year of their lives. "Throughout his daily work the powerful influence of this condition of chronic semi-starvation, not only in the poor Indian himself, but throughout his whole race and generation, is constantly obtruding itself upon the physician, who says: 'This man's constitutional malady is malnutrition, anæmia, asthenia, complicated with fever, dysentry or what not.' Consequently, the first indication for treatment is a proper and nourishing diet." (Norman Chevers, 1886.)

Our next problem of nutrition in India has, therefore, been this: "What are the effects, on the people using them, of diets composed of cereals?" This problem may be approached in two ways, and for its proper solution it should be approached in both ways: by an epidemiological survey of diseases with special reference to dietary conditions (an undertaking so great as to be outside the resources of this laboratory) and by animal experimentation. The latter is the way I have followed.

In India we have to deal with combination of food-faults rather than with single food-faults. There is, for instance, no diet in common use in India which while lacking in any single element or complex necessary for normal nutrition is not at the same time faulty in other regards. It may, indeed, be doubted whether any deficiency is ever complete; deficiency of vitamin C is the most likely one to be complete. It is with "insufficiency," rather than with complete want of certain food factors, that we have to deal; and with a combination of such insufficiencies. Associated with them there is, as a rule, an unbalance of the diet with respect to proximate principles, such unbalance usually takes the form of excessive richness of the food in carbohydrates. It is true that one insufficiency or another may be dominant; as, for example, an insufficiency of vitamin B in rice-eaters. But upon the effects of the dominant insufficiency there are often superimposed those of other associated insufficiencies, of the unbalance of the food in other regards, or of actual under-nutrition. Our problem in India is not so much of the effects of this or that faulty diet. What, then, are the effects on the animal organism of a diet composed wholly or almost wholly of rice? What are those of a diet composed wholly or almost wholly of wheat? And to what extent do these effect, as observed in animals, enable us to account for ill-health in man?

To begin with rice. This cereal has many deficiencies, prominent among them being that of vitamin B. In India rice is the poorest of all cereals in this complex. The effects of rice on the animal organism, either alone or in combination with other food materials in common use by rice-eaters, were studied in the pigeons and monkeys. It was found that the more highly the rice was polished and the more it was washed, the more rapid was the onset of symptoms; and these symptoms were usually of the same kind polyneuritic. But no man lives on rice alone. No matter how great his poverty may be he makes some addition to his rice —a little *dal* (legume), a little vegetable, or a little of both. These additions raise the nutritive and vitamin B value of the diet to some extent; and it is when animals are kept on a diet of this kind—a diet in which vitamin B is not wholly lacking though insufficient for normal metabolism—that we begin to see signs

and symptoms of ill-health which are of great importance in relation to the origin of maladies prevailing amongst rice-eaters. These signs and symptoms are poor appetite, loss of appetite, or (in monkeys) depraved appetite, failure to increase in body weight or actual loss of body weight, vomiting (in monkeys), diarrhœa, dysentery (specific and non-specific), colitis, slowing of the respiratory rate, lowering of body temperature, cardio-vascular depression, progressive asthenia, anæmia, disorders of the skin, œdema, nervous irritability, symptoms referable to malnutrition of the nervous systems, and inter-current infections. The last may lend wide variety to the symptomatology; and it is here that chance comes into play in determining the kind of infection from which the animals suffer. Thus one batch of pigeons, imported for experimental use into this laboratory, had amongst them carriers of the invisible virus of Epithelioma contagiosum. The birds fed on rice diet suffered much from this condition, while well-fed controls did not. Another batch happened to have amongst them carriers of B suipestifer; the birds fed on the rice diets, suffered much from this infection—itself capable of causing neutritis—the well-fed controls did not. A batch of monkeys happened to have amongst them carriers of Entamoeba histolytica; dysentery appeared amongst the ill-fed animals, while the well-fed—amongst whom were also carriers—remained free from it. Thus did faulty nutrition favour infection by invisible virus, bacillus, and amoeba.

It was found also that a number of other factors—age, sex, warmth, cold, damp, chill, balance of the food, previous food conditions, and, above all, individual idiosyncrasy—influenced the onset of symptoms either in the direction of precipitating or of retarding them. Those that precipitated symptoms were such as placed additional burdens on the metabolic resources of the body; those that retarded them were such as conserved these resources. Thus, an addition of an excess of fats to the rice diet hastened the death of both birds and monkeys, while exposure to cold and damp precipitated the onset of œdema—an observation of significance in regard to malnutritional œdema and beri-beri. Associated with these symptoms of ill-health profound changes were found throughout the organs and tissues of the body; these were observable even by the naked eye and the relatively crude method of histoligical examination. Of these changes the most conspicuous were those in the gastro-intestinal tract, the circulatory system, the endocrine organs, and the nervous system. They are now-a-days so well known that little further reference need be made to them; by analytical methods of experimentation many of them have since been traced to particular deficiencies in the diet.

In these observations a parallel is to be found in the poor stamina, muscular development, and physical endowment of rice-

eating races, and in low powers of endurance and resistance to infection of the poorer classes amongst the rice-eaters. A parallel is also presented in the frequent occurrence amongst them of respiratory diseases, gastro-intestinal diseases (diarrhœa, dysentery, cholera, colitis), malnutritional œdema, anæmia, skin diseases, and beri-beri. Interest in the last-named has, because of its occurrence amongst the rice-eaters, over-shadowed the vastly more important and more general effects of the rice-eater's diet. For, considering the millions whose staple articles of diet is rice, beri-beri is relatively an uncommon disease in India. Its distribution is very limited: it is confined, as an endemic, to certain coastal areas of the north-east of Madras and Bengal. In Madras it is rarely seen at a distance of more than 50 miles inland. It is practically unknown on the West Coast of Madras and Bombay, whereas much rice *per capita* is eaten as in localities where it is endemic. Occasional small outbreaks (epidemics) occur in other parts of India, but, for the most part, these are in persons who have emigrated from endemic areas. In India endemic beri-beri is very definitely a "place disease" I do not here speak of "epidemic dropsy" which some in India consider to be a form of beri-beri. Much of the confusion in regard to the causation of beri-beri has arisen from the fact that par-boiled rice and rice which is not highly milled and polished are supposed to contain "plenty of vitamin B." They do not. In this laboratory true beri-beri has been produced in pigeons fed exclusively on diets of under-milled or home-pounded rice or of washed par-boiled rice. A second source of confusion has been the assumption that polyneuritis columbarum is the same condition as beri-beri. It is an analagous condition certainly, but not the same condition, though it may arise under precisely the same dietary conditions as true beri-beri does. Thus if pigeons be fed on a diet simulating that in use by human beri-beri—washed, polished rice plus 0·8 gram of *dal* per bird daily, the latter administered artificially—some will develop no signs either of polyneuritis or of beri-beri, though they may suffer from other maladies within a period of 100 days; others will develop polyneuritis columbarum; others, beri-beri columbarum; others, again, a condition intermediate between these two states. The individual idiosyncracy of the bird is the final factor determining which condition it will suffer from, or whether it will suffer from either.

These two conditions differ from each other as follows:—

The former is a state of polyneuritis and cardiac atrophy with or without œdema; it is most readily and most regularly produced when the rice diet is very deficient in vitamin B. The latter is astate of polyneuritis, cardiac, hypertrophy, and degeneration with (usually) or without (rarely) œdema; it arises when the diet

contains an insufficiency of, but is not wholly lacking in, vitamin B. It is to this latter condition that the term "true beri-beri" can alone be accurately applied. Statistical examination of my experimental data has shown that it is due to an unknown positive factor acting in association with insufficiency of vitamin B. This positive factor is produced in the bodies of birds themselves, and is either a metabolic or a microbic poison. True beri-beri is an intoxication. It is still thought by some that the beri-beri poison can be produced in deteriorated rice outside the body. No evidence in support of this view has so far been forthcoming in the course of work in this laboratory.

There are, thus, a number of polyneuritis states which can arise in pigeons fed on rice-diets; infective polyneuritis due to a microbe such as the B suipestifer; nutritional polyneuritis due solely to avitaminosis; true beri-beri, due to avitaminosis plus an unknown positive agent arising in the bodies of the birds in consequence of the avitaminosis; and intermediate states between nutritional polyneuritis on the one hand and true beri-beri on the other. If there be this diversity of "beri-beri-like" maladies in birds fed on rice diets it is reasonable to suppose that a similar diversity of these maladies will be found in human beings who subsist mainly on rice. All these forms of neuritis are preventable in birds by the same means; the addition to the rice—whether it be from deteriorated stock in use by human beri-beris or not—of a sufficiency of food materials (wheat, tomatoes, legumes, etc.) rich in vitamin B. Human beri-beri, as it occurs in India, is also preventable by the same means and has been so prevented in jails where it was endemic for years. The prescription of ancient Indian Hakims—"stop eating rice and take a diet of wheat and milk"—can hardly be bettered.

So much then for the rice-eater's diet. What of the wheat-eaters? If animals (rats) be fed on an exclusive diet of whole wheat the mortality amongst them is very high. Pulmonary infection is the chief cause of death. If to the diet of whole wheat some good olive or sesame oil, which are poor but not wholly lacking in vitamin A, be added, together with a salt mixture to make up for certain mineral defects in the wheat, the animals live longer and afford greater opportunity for the study of the effects of diets comparable in composition to that used by the poorer class of wheat-eaters. The main deficiency of this diet is one of fat soluble vitamins. Its effects are exhibited as metaplasia of epithelia, throughout the body, a change now recognised as characteristic of vitamin A insufficiency. Infections of the eye, the nasal sinuses, the lungs, are common; urinary calculus is frequent; the goitre is occasionally met with.

In the course of experimental work in this laboratory many

variations of deficient diets, having one or other cereal grain or cereal product or a mixture of such as their basis have been used with results which manifest themselves, for the most part, as "it is's" of various kinds and locations. These need not be enumerated, but some reference may be made to three conditions—"stone," goitre, and "peptic ulcer," which in India are problems of the moment.

The distribution of "stone" is peculiar: it occurs, for the most part, in the north of India and is relatively rare in the south. It is a disease of wheat-eaters rather than of rice-eaters. Experimental work in this laboratory has shown that the cereal grains in common use in India vary in their stone-producing potency, wheat having the highest, the rice the lowest potency, in this regard, while the other cereals occupy an intermediate position between these two extremes. The distribution of stone is, therefore, related to the distribution of cereal crops. The stone-producing potency of white flour is relatively low; and, as white flour contains no more vitamin A than whole wheat flour, it is obvious that in the process of milling some substance favourable to stone production is removed from the whole grain. There are two classes of factors, apart from infection and foreign bodies in the urinary tract concerned in the causation of stone: negative ones—vitamin A deficiency and phosphate deficiency; and positive ones—an unknown substance existing in different amounts in different cereals, and excess of lime in the diet. Cattle-stones are, in India, almost invariably composed of calcium carbonate. The dietary conditions under which they arise in nature or are produced under experimental conditions in the laboratory are the same; deficiency of vitamin A and deficiency of phosphates relative to the amount of lime in the diet. Work in this laboratory has convinced that, in India, urinary calculus is usually a disease of faulty nutrition.

The distribution of "goitre" is also peculiar, it occurs chiefly in Himalayan regions. In these the iodine content of the soil is low and no doubt also that of the food materials grown upon it. But the iodine content of the urine is not significantly higher in non-goitrous than in goitrous persons in these regions; and, while admitting that iodine deficiency may favour the development of certain kinds of goitre, such deficiency is not regarded as the essential cause of the disease. With the possible exception of the adrenal glands and thymus no organ or tissue of the body is more sensitive to food conditions than the thyroid. The iodine content, the fat content, the lime content, the phosphate content, the vitamin content of the food, all these influence its size, as do certain unknown substances in food materials such as cabbage and groundnuts. Its size also is influenced in certain circumstances by insanitary conditions of life. Iodine is by no means

the be-all and the end-all of goitre. Four etiologically distinct types of goitre have been produced in this laboratory, the hyperplastic, the hypertrophic, the colloid and the lymph adenoid, but all have this in common, they are preventable by the same reasons. This means the provision of a perfectly-balanced diet such as the lacto-vegetarian one previously described. Thus, insanitary condition, a positive giotrogenic agency, will not cause goitre when the animals are properly fed, it will cause goitre when they are not. Goitre is, in the main, a disease of faulty nutrition; but, like beri-beri and like urinary calculus, both negative and positive factors are concerned in its causation.

"Peptic ulcer" has also a peculiar distribution. It is very common in the south of India, particularly in Travancore. It has been shown in this laboratory that the tapioca diet of the poorer class Travancorian will cause this condition in 27 per cent. of albino rats fed upon it; that of the poorer class, Madrassi, 11 per cent.; while the lacto-vegetarian diet of the Sikhs affords the animal's complete protection against it. Some ten years ago it was observed, in this laboratory, that deficiency of vitamin C was capable of causing duodenal ulcer in guinea-pigs.

A pernicious type of anæmia may occur in albino rats when they are fed on a diet of oatmeal, linseed meal, and patent flour. It is due to rat-house borne organism—Bartonella-muris. As is well known this organism gives rise in these animals to a profound anæmia on removal of the spleen. It is of significance, in regard to such maladies as malaria, typhus, relapsing fever, and Kala-azar—all widely prevalent in India and favoured in their course and development by famine conditions—that the protective resources and of the spleen can be injured by faulty nutrition in a way comparable to that brought about by splenectomy.

Other diseases of faulty nutrition—keratomalacia, night-blindness, rickets, osteomalacia, tetany, dental caries, scurvy, pellagra, anæmia of pregnancy, and lathyrism—all concern us, to a greater or lesser extent in India; and many other conditions, such, for instances, as cataract and sprue, may have a malnutritional basis of the nature of which we as yet know but little. Kerato-molacia is common, and is the chief cause of preventable blindness (Wright, 1931). It occurs in under-nourished, poverty-stricken persons, whose diets are not only deficient in vitamin A, but in other vitamins as well. "In all probability it requires an initial multiple vitamin deficiency, with a secondary multiple disfunction of glandular structures to account for the whole picture of degeneration, loss of function, wasting, necrosis, secondary infection, and death which we see in kerotomalacia." (Wright, 1931). Night-blindness is also common—well known to ancient Hakims in India who treated by the administration of liver. It is frequently asso-

ciated with lathyrism in localities where the latter conditions prevail (McCombie Young, 1927). "In Northern India and Kashmir rickets in its various forms, osteomalacia, late rickets, and infantile rickets tend to occur in any race or caste wherever there is deficiency of sun-light or diet, or more frequently where there is relative deficiency in both these factors." (Wilson, 1930-31). It is of a greater severity amongst those who observe *purdah* conditions of life. Osteomalacia accounts for much maternal mortality in child-birth (Vaughan). Tetany is frequently associated with rickets—it is endemic in certain valleys of the Himalayas (McCarrison, 1910). Dental caries and hypo-plasia are widespread amongst Indians whose diets are composed mainly of cereals and are deficient in fat soluble vitamins and vitamin C. If deficiency of vitamin D be the chief cause of dental caries it is obvious that tropical sun-light does not provide enough for its prevention. Scurvy, usually in minor form, is widespread throughout the whole of India; and pyorrhœa alveolaris is frequently to be found in persons whose diets contain far too little fresh vegetable foods. Pellagra appears to be relatively rare. The anæmias of pregnancy are common: they are malnutritional in nature, occurring in women whose diets are both quantitatively and qualitatively deficient (Wills, 1928—31). Epidemiological investigations carried out by McCombie Young (1927) from this laboratory have shown that lathyrism is associated not only with the predominance of lathyrus sativus in the diet, but with under-nutrition and deficiency of fat soluble A.

The problem in connection with all these diseases is no longer one of lack of knowledge of their nature, nor of their means of prevention; but one of the improvements of conditions of living and of food-supply of the people. Indeed, the greatest of all problems in India at the present time is the adjustment of the population to its food-supply. It is one that is capable of solution only by the people themselves; by the exercise of self-help; by the jettisoning of old habits and customs unsuited to modern economic conditions; by improvements in methods of agriculture, animal husbandry and industry; and, above all, by restraint in reproduction.

Recently (1931) I had occasion to contrast the incidence of disease in 2,243 improperly-fed albino rats with that in the well-fed stock rats in this laboratory. It was shown that while the former exhibited a large proportion of the maladies included in the calendar of human ailments the latter were remarkably free from disease of any kind. The only significant difference in their conditions of life was the improper feeding of the one "Universe" and the proper feeding of the other. It seems to me that, how-

(*Continued on page* 85)

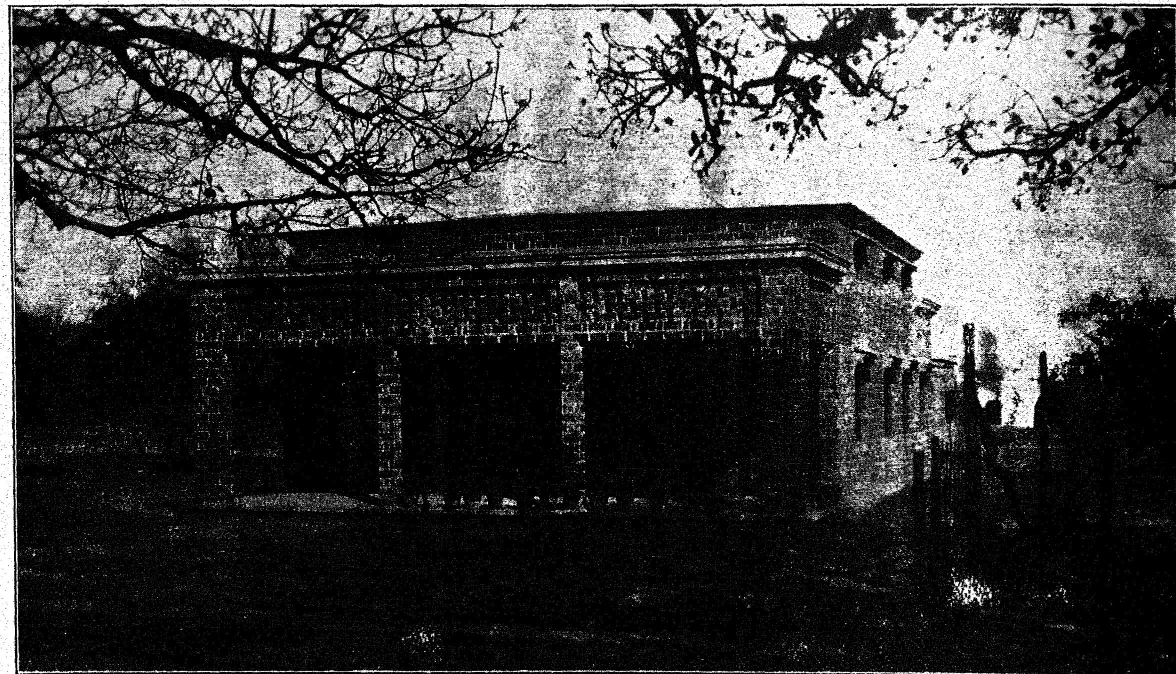
ANOTHER MODEL SMALL BUNGALOW.

[By Mason Vaugh, B.Sc., Ag., A.E. Engineer, Agricultural Institute, Allahabad.]

The model small bungalow described in the "Christian Medical Journal" of July, 1931, was designed for a fairly high grade man on a salary of Rs. 350 to Rs. 500 or so. In this article it is proposed to describe one suitable for the man on Rs. 100 to Rs. 250, where a rental of approximately five per cent. of the cost of the bungalow is to be paid. The other one was adapted to a semi-or full European style of living. This one is adapted to the needs of the family living in Indian style, rather simply, with the woman doing a large part of her own cooking at least, and suited to the minimum amount of help from servants. It is also especially adapted to the needs of a man working in an institution where he is expected to do a certain amount of study, and may have need to see students or patients who are not taken into the family quarters.

The requirements set down were for the following space:—Two rooms for the use of the family privately, bed-rooms and rooms which can be utilized in the day-time as well; one sitting room or public reception room where family guests may be received and which can be used by the family as a living room, if desired; a study which can be used as an emergency guest room, for a single man not to be taken too freely into the bosom of the family; a kitchen; a small store room for supplies, etc.; a verandah for dining and general family use; sanitary toilet, and bathing facilities somewhat detached from the house but easily accessible, and an enclosed courtyard for privacy in doing the daily washing, etc. The floor plan reproduced herewith shows quite clearly how these facilities are provided.

Considerable time and thought were given to the working out of the plan in the effort to secure the maximum of comfort and convenience for the family at minimum cost. The construction is *pucca* throughout, the brick being for the most part first class overburned for outside walls, and second class for interior walls. The latter are nine inches thick, and of the hollow construction used in the bungalow previously described, for the outside walls and the load-bearing partitions. The partitions between the study and the sitting room, between the bed-room and living room, and the walls dividing the kitchen and store from the verandah, are all brick-on-edge, laid in cement mortar, and so just less than four inches thick including plaster. The four main rooms are plastered. The kitchen, store and verandahs are only whitewashed on the brick directly. The roof is reinforced brick, with cement plaster on top and lime plaster inside. Floors are cement and brick throughout, made by the method described in the July, 1931 issue



Another Model Small Bungalow

of the JOURNAL. Those in the main rooms are finished with a cement plaster, the others being left plain brick. So far it has been free of attack by white ants, and it is confidently expected that it will remain so.

The built-in conveniences should be noted. Built-in book cases are provided in the study and sitting rooms. Shelves for utensils are provided in the kitchen and for supplies in the store. The wall between the bed-room and sitting room consists of two cupboards, one for hanging coats, etc., opening into the living room, and a capacious shelf closet opening into the bed-room for the storage of bedding, family clothing, etc. These cupboards are carried up to a height of about seven feet, and the top is made of a strong reinforced-brick slab. The wall is carried up straight on the living room side, leaving a shelf in the bed-room for the storage of tin trunks, suit-cases, etc. The kitchen is equipped with a sink with running water, and drainage to the septic tank. It also has a built-in stove designed to burn wood in pieces as it is bought, without the necessity of cutting it into short lengths. The stove is attached to a chimney for drawing the smoke out through the roof. The top is of cast aluminium, for quick and easy heating, and fuel economy. It also has an oven in which baking of bread, cakes, etc., can be done. The stove is built low down to facilitate the burning of long wood, and to make it possible for the woman to sit and cook, as is the custom in most Indian homes. Except for the top of aluminium and the oven of sheet iron the remainder of the stove is made of brick and cement. It has been in use for some months, and is very well liked by the occupants.

The location of doors should be noted. They are all placed in the corners giving the maximum amount of usable wall space. The fact that the building is white-ant proof allows furniture to be put against the wall without fear; increasing the apparent floor space. With the exception of one or two doors taken from other buildings all are single leaf doors, made of a simple frame and two-ply wood panels. The upper panel is twice the size of the lower one, which gives a pleasing proportion. Outside doors have the upper two-thirds glazed. Again due to the freedom from white ants it is possible to use cheaper woods, and the doors are made of *chir* (pine) frames and imported birch three-ply wood, four and-a-half millimeters thick. The wooden door and window frames are made without any cross-piece at the bottom. The side pieces are set slightly into the cement instead, which gives them ample rigidity. The lack of the bottom cross-piece facilitates sweeping and scrubbing in the case of the doors, and lessens the leakage of water in the case of windows. A slightly-raised sill is formed in the cement of the floor or window sill. Windows are made three

feet above the floor, to make possible setting a table under them if desired.

The latrine facilities are simple but adequate. A very simple type of flushing seat is provided by using a 'gully trap,' which is a simple earthenware trap originally made for trapping drains where they are connected to a sewer. The trap has a six-inch square opening, and is made for connection to a four-inch glazed earthenware pipe at the outlet. The trap is set into the cement-brick floor of the latrine, and foot-rests are made on either side by the use of bricks cemented over. A channel is provided in front for urine to drain into the trap. The floor is sloped slightly, so that wash water drains into the trap also. Flushing is carried out by simply pouring a bucket of water into the seat. From one to one and one-half gallons are required at a time. It is, therefore, not dependent on running water, though a faucet in the latrine is a great convenience, of course. Where water is not available and the soil is suitable, a bore-hole latrine could be substituted. The bathing place alongside provides a place for washing of clothes as well as bathing. The water from it is not put into the septic tank, but utilized for gardening.

The cost is quite moderate. The cost of the building, including sanitary equipment, wiring for electricity (but no fans), and the built-in fixtures was Rs. 3,500. This does not include the cost of land or fencing, but only the cost of the building itself. The house is designed to be built in blocks of two, with the *angans* (courtyards) adjoining. This does not mean any important saving, but does provide against the prevailing objection, in North India at least, to wholly detached bungalows.

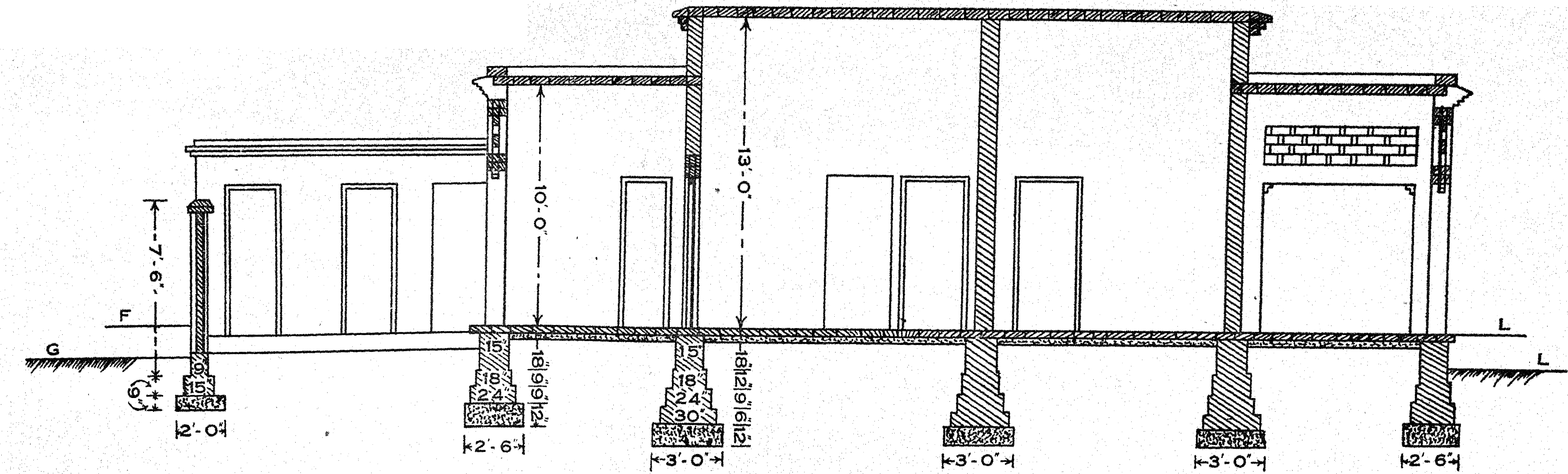
(*Continued from page* 81)

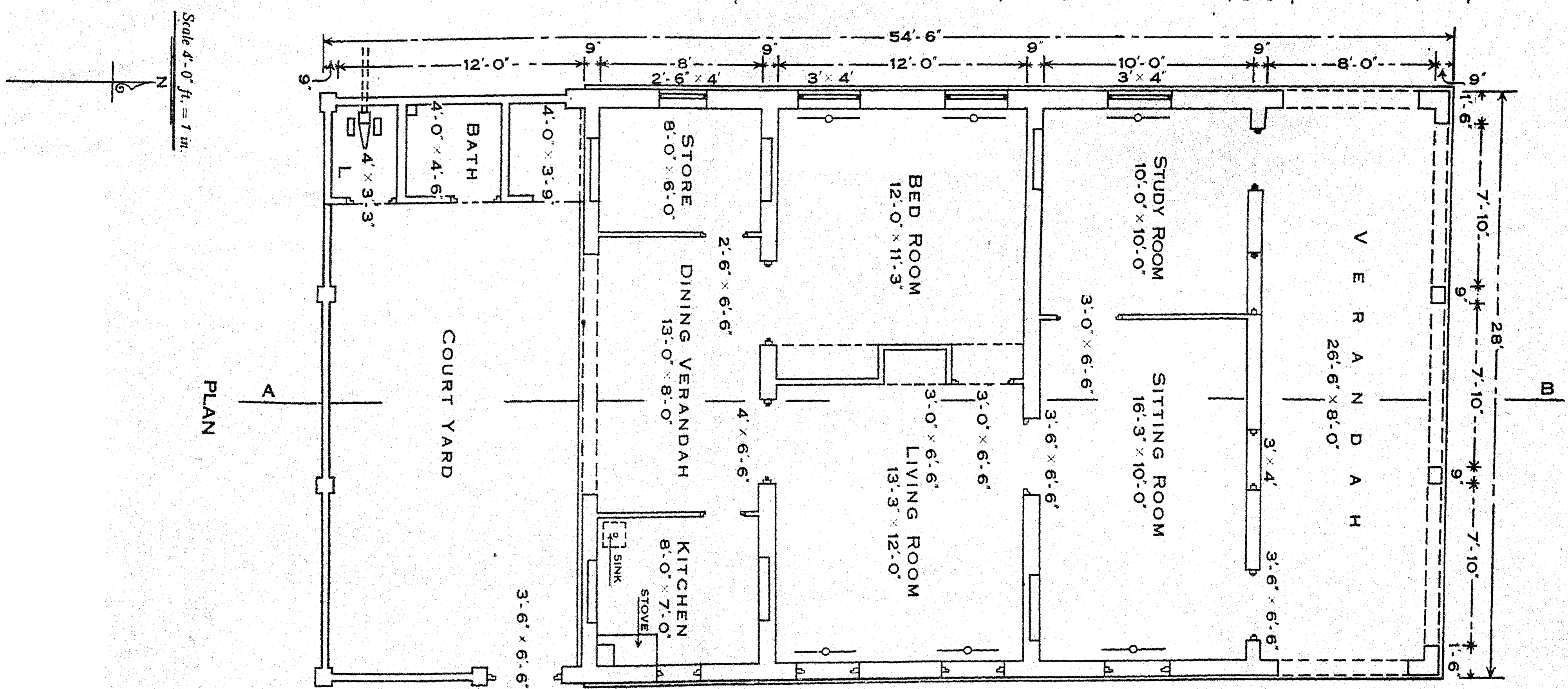
over, deeply we may delve into the minutes of the relationship of faulty nutrition of disease, the essence of the whole matter will be found to lie in this; the use of a properly-constituted diet is a sure means to the attainment of physical efficiency and health. Such a diet is the lactovegetarian one in use by certain vigorous and resolute races of Northern India.

(From "Nutrition Abstracts and Reviews," vol. II, No. 2, July, 1932.)

A Dog Licensing Act in each province would go a long way to clearing up the problem of stray and ownerless dogs.

SECTION ON A.B.





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METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE FARM.

December, 1933.

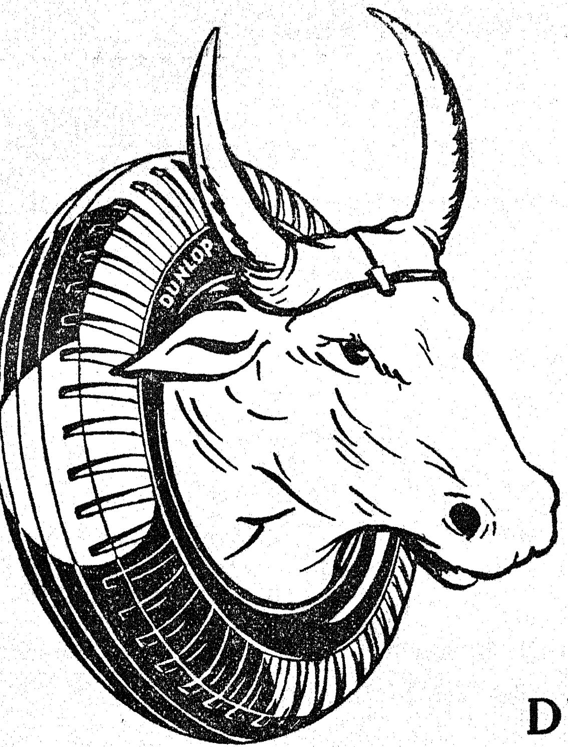
Dates.	Max. Temp.	Min. Temp	Rear. Temp.	Humidity	Atmos-pheric Pressure.	Rain for the Day.	Rain since Jan. 1.	Direction of the Wind.	Remarks.
1	73	47	60·	60	29 75	..	28·12	W.	
2	72	47	59 5	82	29·76	..	,,	S.W.	
3	73	49	61·0	85	29 75	..	,,	W.	
4	74	50	62·0	92	29·72	..	,,	Calm.	
5	75	49	62·0	92	29 76	..	,,	W.N.W.	
6	75	50	62·5	86	29·79	..	,,	Calm.	
7	75	50	62·5	85	29·75	..	,,	W.	
8	74	50	62·	88	29·75	..	,,	W.	
9	75	49	62·	85	29 74	..	,,	W.	
10	74	45	59·5	88	29·76	..	,,	W.N.W.	
11	73	46	59·5	90	29·76	..	,,	S.	
12	72	48	60·0	80	29 74	..	,,	E.	
13	72	50	61·0	80	29·76	..	,,	S.	
14	74	48	61 0	80	29·78	..	,,	W.	
15	74	42	58·0	91	29·74	..	,,	E.	
16	68	42	55·0	85	29·76	..	,,	W.	
17	68	41	54·5	80	29·84	..	,,	W.S.W.	
18	68	43	55·5	75	29·90	..	,,	W.S.W.	
19	68	41	54·5	95	29·86	..	,,	W.S.W.	
20	68	46	57 0	94	29·82	..	,,	E.S.E.	
21	66	48	57·0	92	29·84	..	,,	Calm.	
22	70	48	59·0	90	29·82	..	,,	W.	
23	72	51	61·5	92	29·70	..	,,	E.	
24	72	51	61·5	90	29·65	..	,,	W.	
25	72	48	60·0	88	29·66	..	,,	W.	
26	72	46	59·0	85	29 68	..	,,	N.W.	
27	72	47	59·5	95	29·68	..	,,	Calm.	
28	72	46	59·0	90	29·66	..	,,	Calm.	
29	72	47	59·5	88	29·70	..	,,	S.W.	
30	73	47	60·0	96	29·72	..	,,	Calm.	
31	74	46	60·0	90	29·74	.	,,	Calm.	

January, 1934.

Dates.	Max. Temp.	Min. Temp.	Rear.	Humidity.	Atmospheric Pressure.	Rain for the Day.	Rain since Jany. 1.	Direction of the Wind.	Remarks,
1	72	45	58·5	90	29·80			Calm.	
2	73	50	61·5	89	29·82	..	28·12	E.	
3	75	50	62·5	85	29·80	..	"	E.	
4	75	52	63·5	88	29·80		"	S. E.	
5	74	52	63·0	75	29·82	..	..	E.	
6	75	55	65·0	80	29·80	..	"	E.	
7	75	50	62·5	85	29·78	..	"	Calm.	
8	74	49	61·5	80	29·74	..	"	E. N. E.	
9	71	53	62·0	70	29·80	..	"	S. E.	
10	73	56	64·5	80	29·74	..	"	N.	
11	73	57	65·0	85	29·64	0·5	0·5	E. S. E.	
12	73	58	65 5	95	29·60	·17	·22	"	
13	75	52	63 5	85	29 68	05	·27	W. S. W.	
14	62	43	52·5	80	29·72	..	"	W.	
15	64	42	53·0	75	29·74	..	"	S. W.	
16	66	36	51·0	70	29·82	..	"	W.	Earthquake shock at 2-15 p. m. to-day. There was frost and some crops were damaged.
17	66	38	52·0	65	29·76	..	"	W. S. W.	
18	68	40	54·0	60	29 80	..	"	W.	
19	66	35	50·5	60	29·82	..	"	W. S. W.	More frost and more crops were damaged.
20	66	44	55·0	45	29·72	..	"	E. S. E.	
21	72	44	58·0	55	29·68	..	"	E. S. E.	
22	71	44	57·5	70	29 82	..	"	W. S. W.	
23	64	40	52·0	60	29 82	..	"	W. S. W.	
24	64	37	50·5	40	29 84	..	"	W. S. W.	
25	69	37	53·0	50	29·84	..	"	N.	
26	70	38	54·0	55	29·86	..	,	N. N. W.	
27	73	44	58·5	60	29 80	..	"	E.	
28	81	50	65·5	65	29·70	..	"	E.	
29	83	61	71·5	95	29·66	0·58	85	E.	
30	69	56	62·5	95 0	29 70	0·05	90	E.	
31	71	45	58·0	85 0	29·88	..	90	W.	Foggy morning.

Summary of Rainfall in 1933.

Year.	Jany.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1933	..	0·14	1·47	1·57	1·81	3·15	6·42	8·80	11·02	1·74	..	..	28·12
Normal	74	0·50	0·30	0·14	0·31	4·85	12·12	11·55	5 78	2·21	27	26	39·06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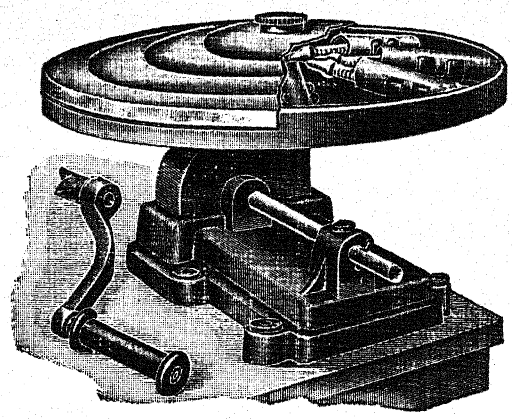


A. P. Brooks

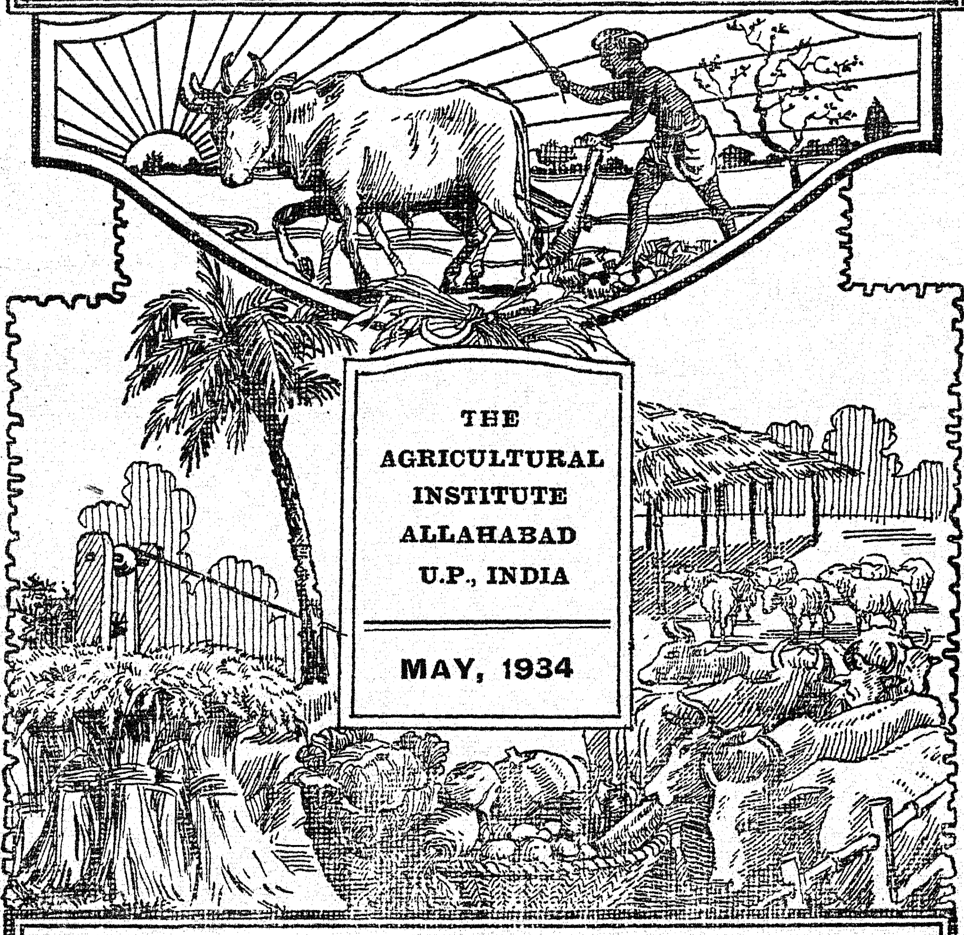
VOL. VII [No. 3

THE ALLAHABAD FARMER

A bimonthly Journal

OF

Agriculture and Rural Life



THE
AGRICULTURAL
INSTITUTE
ALLAHABAD
U.P., INDIA

MAY, 1934

"There must be reform from the top in India. But there must be also the reform which proceeds from the bottom upwards, and such reforms must begin with the Indian village."

THE MANCHESTER GUARDIAN WEEKLY,
December 8, 1933.

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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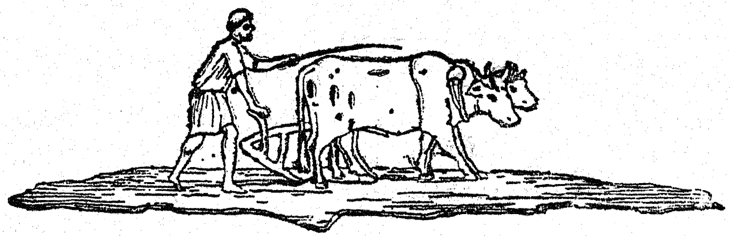

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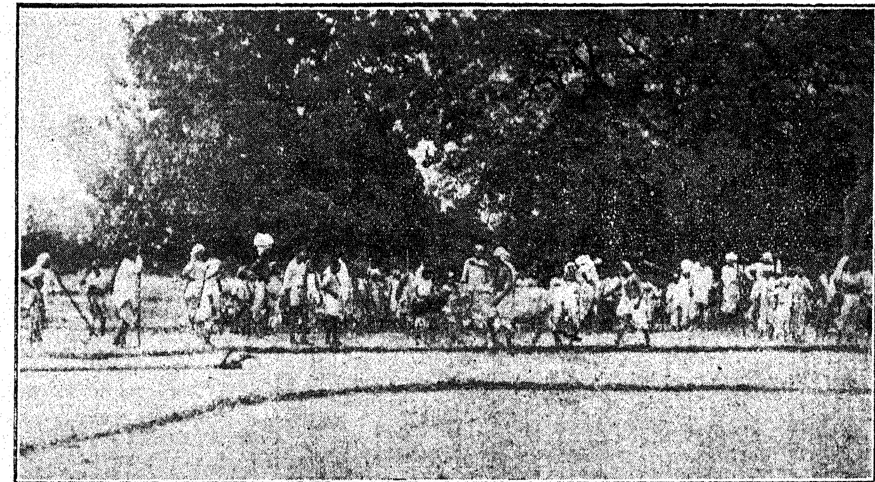
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION—SERAI AQIL

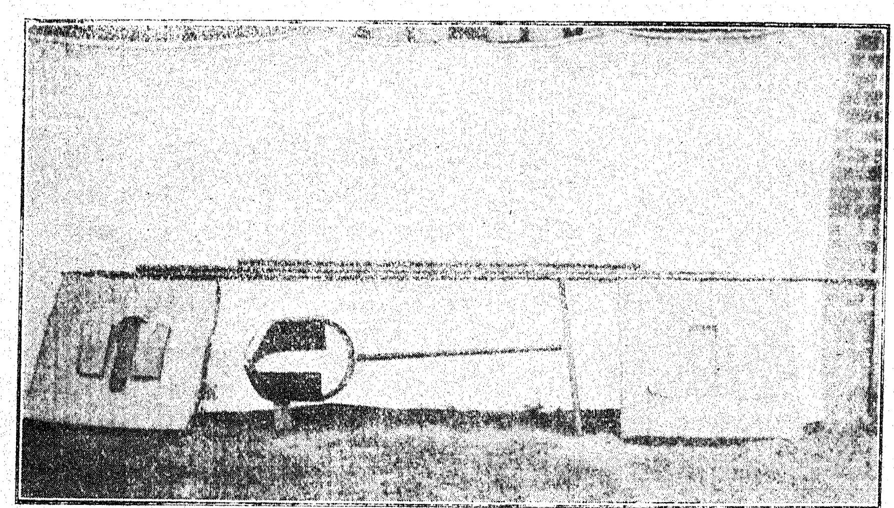
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE

ALLAHABAD FARMER

VOL. VIII] MAY, 1934 [No. 3

Editorial

The case of the Indian Farmer.

India like Egypt and China, but unlike America or Australia, is amongst the oldest countries of the world. Its civilisation is as old as, if not older than, the civilisation of the oldest nations of the world to-day. This civilisation started when the people began to settle down on the land, that is when people began farming; and that was several thousand years ago. But in spite of this very early start in learning the art of farming, agriculture in India to-day is almost the same what it was a thousand years ago. It is therefore not at all surprising that we hear in these days of the Australian wheat being dumped in the markets of India; of the Japanese rice coming to the Calcutta market, one of the greatest rice producing centres of the world; of the California oranges being sold in the Indian markets; and so on. Thus the newer regions like California and Australia, whose modern agriculture as we know it started only a few decades ago, have now got a start over us and we are being left behind. Thus the country which once supplied the world in abundance with silk, carpets and cotton fabrics is now reduced to the condition of a customer not only of those articles but also of food-stuffs from other countries. The result is that India once the richest country of the world, has now become the poorest on the face of the earth. India's farming population which constitutes the backbone of the nation are living the most miserable existence on earth. About half of the farming population of India goes from one day to another throughout the year without having their hunger satisfied. India, without any doubt, needs more food and clothes. But these things can only be obtained by devoting our energies to agriculture, the premier industry of the nation. By agriculture we do not mean only crop production as is generally understood, but it includes the raising of sheep and cattle, the production of milk, and also those industries connected with agriculture; most of which being those small-scale or domestic industries of which India at one time used to be proud of.

The average production per acre in India has been estimated to be about Rs. 25 while in Japan where scientific agricultural education has reached the mass of the people, the average production is about Rs. 150 per acre. This difference is not due to any lack of intelligence of the Indian farmer, but to the lack of the knowledge of modern scientific agriculture.

The solution to this problem, therefore, is thiough the introduction of agriculture in schools, the education of the adult farmer through several agencies like co-operative societies, farmers' clubs, farmers' fairs, agricultural exhibitions; a closer relationship between agricultural institutions, demonstration farms and the peasant farmer.

It is the aim of this magazine to make its contribution in trying to bring to the farmers of India this scientific knowledge of agriculture in order to help the advancement of rural India.

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Editorial Notes and Comments

The Farmers' Fair which has now become an annual feature and is being held on the grounds of the Allahabad Agricultural Institute and which was held this year from the 7th to the 10th March, has increased its popularity judging from the large crowd of visitors who came to it. Among the visitors there were not only the gentry of Allahabad who were drawn to it by exhibits of scientific interest displayed, but also by a large crowd of farmers who came mornings, afternoons and evenings not only to visit it but also to take part in the ploughing and other competitions which are additional features of the programme this year. Several of the women of the vicinity received many prizes for the best exhibits at the fair.

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Editor on Furlough

Mr. W. J. Hansen, our editor of the "Allahabad Farmer" left this country early in April on a two years' furlough in America. While we feel sorry to lose Mr. Hansen's capable services as editor of the "Farmer", during these two years, yet we feel sure that he deserves this long furlough after the very busy time he had had here during his first term of service in India. We understand that Mr. Hansen had to go early in April so as to arrive in Rome in time for the World's Dairy Congress, to which he was appointed a delegate by the Government of India. Mr. Hansen has done so much

for the dairy industry in India, that we feel he richly deserves this appointment. The cause of dairying in India will be well represented by him. He will then proceed to America where he hopes to spend most of his furlough in acquiring more knowledge which he will place in the service of this country when he returns.

Mr. W. J. Hansen's furlough necessitated a little change in the staff of the "Farmer." Dr. Higginbottom, our Principal, will be our contributing editor and we hope therefore that the "Farmer" will get very valuable contributions from his pen in its coming issues. Mr. A. T. Mosher, a new member of our staff from America, has also been added to the editorial staff of the "Farmer." Although he is new to us, Mr. Mosher is a well-tried journalist in America.

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Indian Dairy Diploma

According to the reports of the Imperial Dairy Department, six out of eight candidates who appeared from the Allahabad Agricultural Institute in the last Indian Dairy Diploma examination passed and two failed. Those who passed are (1) Dharambir Kakkar, (2) Gyan Ranjan Rai (3) Purnendro Roy, (4) R. N. Sen Gupta, (5) S. U. Patel, and (6) S. L. Singal. We congratulate those who have passed but our sympathy goes to the other two who failed. It is rumoured that the two who failed are not in any way inferior, and at least one of them is decidedly better than most of the others who passed. This is just another evidence that an examination is not a sure test of one's knowledge, especially when the whole examination, including theoretical and practical papers, is in the hands of one examiner.

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Agricultural Colleges

In the Statistical Abstract for British India, published in 1933 it is stated that the total expenses from all sources on agricultural colleges was as follows: Burma, Rs. 2,31,735; the United Provinces Rs. 1,75,418; Bombay Rs. 1,73,308; the Punjab Rs. 1,41,740; Madras Rs. 1,04,023; Central Provinces and Berar Rs. 75,212; Bengal and Assam, nil. In Bihar and Orissa there is no expenditure on agricultural colleges from the provincial revenues.

The total educational expenses at the Allahabad Agricultural Institute for the year 1932-1933 are Rs. 57,612-13-8; while the income from the students is Rs. 13,740-13-0; so that the Institute contributes approximately Rs. 400 a year for each student.

The students who come to the Institute are distributed according to provinces as follows:

United Provinces 48; Bihar and Orissa 11; Bengal 10; Madras 8; Punjab 4 and Assam 2; Other provinces and States 25. So the Institute contributes about Rs. 19,000 for giving agricultural education to the college men of United Provinces, Rs. 4,400 for Bihar and Orissa; Rs. 4,000 for Bengal; Rs. 3,200 for Madras; Rs. 1,600 for the Punjab and Rs. 800 for Assam. Is it too much for the Institute to expect the Governments of these provinces to pay a certain amount towards the education of their young men? We do not think so.

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Plague

Plague we understand is prevailing in some of the villages in this province. This terrible scourge of mankind generally spread through fleas which live in dogs, cats, rats, mice, squirrels, etc. The insects carry the germs of the disease which they infect human beings by biting. Hence it is very essential that fleas should be controlled if they cannot be totally destroyed.

If a dog or pet is kept in the house, a carpet or rug for the animal should be provided for. This carpet should be given a thorough shaking every morning and brushed, and the dust thus removed should be burnt along with sweepings from the room, as these may contain the eggs of these parasites.

When there is an outbreak of fleas, the infested rooms should be sprinkled with pyrethrum powder or with "flit". In serious outbreaks of fleas tho floor covering should be removed and the floors washed with soap.

How to Control Aphides

Aphides or green flies called in Hindustani mahu, are by far the most common insect pests in United Provinces. They may be controlled by spraying with tobacco decoction. The solution must be strong in order to make an effective spray. One seer of tobacco leaves should be steeped in ten seers of water. This solution is very effective as a spray against aphides and thrips.

The population of India increased by 34,000,000 from 1921 to 1931.

THE RECLAMATION OF SALT AND ALKALINE LAND

[By E. Mackenzie Taylor, Director, Irrigation Research, Punjab.]

The methods that can be adopted in reclaiming land containing salts are based on a knowledge of the chemical reactions which take place between the salt and the clay in the soil, the effect of these reactions on the behaviour of the clay towards water and on the resulting physical properties of the soil. A brief account of the reactions that take place in the removal of salts is necessary in order to understand the methods adopted. It may be stated that the soils of the Punjab generally have a lower clay content than those met with in Egypt and that the principal salt met with in Punjab soils is sodium sulphate while that present in Egyptian soils is sodium chloride.

The removal of salts, such as sodium sulphate and sodium chloride, from the soil by leaching appears to have been regarded as a simple mechanical process. Chemical reactions take place, however, during the leaching which have an important bearing on the further treatment of the soil.

The clay in a normal soil is mainly present in the form of calcium clay. A soil containing calcium clay is permeable to water and air, the conditions in it are ærobic and the methods to be adopted in the cultivation of such a soil are well-known. All alluvium deposited in fresh water belongs to the calcium clay type. When a solution of sodium sulphate is brought in contact with a calcium clay soil, base exchange takes place, the sodium replacing the calcium in the clay, resulting in the formation of a sodium clay. The reaction is shown in the following equation:—

$$Na_2\ So_4 + Ca - Clay = Na_2 - Clay + Ca\ \ So_4.$$

If land containing sodium sulphate is leached, the above reaction takes place and the drainage water will contain some unchanged sodium sulphate together with the calcium sulphate produced as the result of the reaction. Owing to the alternate dry and wet periods in the Punjab, this reaction has taken place repeatedly in certain soils so that the main clay type present in these soils is now sodium clay. The sodium clay formed is not suitable without further treatment for the production of general farm crops. The leaching of salts from the soil is only the first stage, therefore, in the reclamation.

A further point that must be mentioned is that so long as the solution of sodium sulphate remains above a certain concentration, the sodium clay is stable and flocculated. The soil in this condition is permeable to water. It follows that the removal of the sodium sulphate by leaching is possible so long as the solu-

tion of sodium sulphate is above a certain critical concentration. Below this critical concentration of sodium sulphate, the clay becomes deflocculated and the soil impermeable as will be explained later. The complete removal of sodium sulphate from a soil by simple leaching is neither possible nor is it desirable as the land becomes impermeable.

When the concentration of the sodium sulphate solution falls below the critical point, the sodium clay is no longer stable but begins to break down as the result of hydrolysis according to the following equation:—

$$Na_2\text{—Clay} + H_20 = {}^2Na \quad OH + H_2\text{—Clay}$$
(alkaline)

The result of this reaction is that the clay is now in the presence of a solution of sodium hydroxide which is alkaline. In this solution the clay becomes deflocculated and the soil is impermeable to water. The first result of this is that the soil can no longer be leached. The second result is that the soil is quite unsuitable for crops, with the exception of sugarcane and rice, owing to the anærobic conditions in the soil. Continuous leaching of salts from the soil converts a "white Alkali" soil into a soil containing sodium clay undergoing hydrolysis. Howard thinks that alkaline conditions result from poor aeration, the reverse is the case, the alkaline condition produced by the hydrolysis of sodium clay results in poor aeration.

It was formerly thought that a "Black Alkali" soil contained sodium carbonate. I have examined a large series of such soils and have recently shown that a black alkali soil does not contain sodium carbonate except under certain conditions at the actual soil surface. The alkalinity of this type of soil is not due to sodium carbonate but to the presence of sodium hydroxide formed by the hydrolysis of sodium clay. This conclusion is important in connection with the action of gypsum on such soils and their general treatment. From the foregoing, it will be seen that there is a direct connection between a white alkali soil and a black alkali soil, continuous leaching converting the former into the latter. Uncontrolled leaching of a white alkali soil may result in actual soil deterioration. Land may be met with at any stage between a high salt content and alkaline land. As a general rule, the more *salt* a soil contains the easier it is to reclaim.

The difficulty in land reclamation is to overcome the effects of hydrolysis produced by leaching. The methods that can be used are as follows:—

1. Methods devised for the direct cultivation of the sodium clay.

2. The conversion of the sodium clay into some other type of clay by base exchange.
3. The prevention of the hydrolysis of the sodium clay and the direct cultivation of the soil.
4. Producing conditions in the soil so that continuous hydrolysis can take place resulting in the destruction of the sodium clay.
5. Application of sulphur as a fertilizer.

I propose dealing with each of these methods.

1. *Methods devised for the direct cultivation of the sodium clay*:—At the present time, the types of crop that can be grown directly on a hydrolysing sodium clay are very limited. The two principal crops are rice and sugarcane. If the crops desired are limited to these two, then reclamation can be said to be effected by simple leaching, the standard of reclamation is in this case low. If wheat, cotton and clovers are to be grown, then leaching will not effect reclamation. It may be possible to develop new methods of cultivation of this type of clay and to put the land under a normal series of crops. This method will be referred to under (3).

2. *The conversion of the sodium clay into some other type of clay by base exchange.*—Attempts have been made to alter the sodium clay by base exchange with solutions of salts. The salts which have been usually tried are calcium sulphate and calcium chloride. In addition, under certain conditions, I have had successful results with magnesium sulphate and ferrous sulphate.

(*a*) Calcium sulphate was originally suggested by Hilgard because it was supposed that sodium carbonate was present in alkaline soils. The reaction between calcium sulphate and sodium carbonate would lead to the formation of calcium carbonate and sodium sulphate. The former would be precipitated in the soil and the latter could be removed by further leaching. As sodium carbonate is now known not to be present, this theory of the action of calcium sulphate does not hold. It is now supposed that calcium sulphate and the sodium clay react to form a calcium clay which can be cultivated and sodium sulphate which can be removed by leaching. Unfortunately calcium sulphate is very slightly soluble in water and the solution is never concentrated enough to produce base exchange to any appreciable extent. The calcium sulphate temporarily flocculates the sodium clay, as a result of which, conditions in the soil become æroble and the soil permeable. As soon as the quantity of calcium sulphate is reduced below the amount necessary for flocculation, the land reverts to it former condition and further dressings of calcium sul-

phate become necessary. "Reclamation" by the use of calcium sulphate is temporary and owing to the repeated dressings necessary, it is expensive. The action of calcium sulphate has been studied by me in Egypt and Cambridge and the investigations are being continued here.

(*b*) Calcium chloride is more soluble than calcium sulphate and therefore a solution can be formed sufficiently concentrated to produce base exchange, a calcium clay being formed. Owing to the large amount of sodium to be replaced in a soil, it is only on *light* soils that calcium chloride can be economically used as the quantity required is large.

(*c*) I have used magnesium sulphate successfully as a salt to produce base exchange. The resulting magnesium clay is suitable for general crop production though it is more difficult to obtain a good texture than in a calcium clay. When the land to be reclaimed is heavy, the cost is again excessive unless a crop with a high selling value can be produced.

(*d*) Ferrous sulphate has been used successfully in South Africa on my recommendation. The clay produced in this case is a ferrous clay which on oxidation forms a friable ferric clay. The soil treated was light, the amount of replaceable base low, and the land was used for fruit production. The treatment was successful but it is too expensive for ordinary farming conditions.

The methods of reclamation by base exchange can be used successfully but are generally too expensive for the farmer to adopt.

3. *The prevention of the hydrolysis of the sodium clay and the direct cultivation of the soil.*—The hydrolysis of the sodium clay can be prevented by the use of water of fairly high conductivity. This method is being further investigated in the laboratory. An Experiment which I carried out in Egypt was successful. In this case the soil was alkaline-black alkali and instead of using canal water for irrigation, drainage water was used. The soil when irrigated with canal water gave no crop, but with drainage water a fair crop of cotton resulted. The water of high conductivity prevented the hydrolysis of the sodium clay and hence the soil was permeable, the conditions aerobic, and suitable for crop production. The method is also being tested on my suggestion at the Imperial College of Tropical Agriculture, Trinidad, in connection with the cultivation of certain impermeable clays on which it is desired to grow sugarcane. The method may be of particular importance in the Punjab in connection with the reclamation of Bara soils. Either drainage from other areas may be used for irrigating these soils or wells in the area which yield water of high conductivity may be used as the source of irrigation water. If drainage water can be used successfully for the irrigation of

these soils, it will considerably alter the economics of drainage construction in areas affected by waterlogging and *kallar*.

4. *Producing conditions in the soil so that continuous hydrolysis can take place resulting in the destruction of the sodium clay.*—The production of conditions in the soil so that continuous hydrolysis of the sodium clay may take place is the method most generally used for reclamation work. After the leaching of salts to the critical concentration rice is grown in land undergoing reclamation. The reason usually given for growing rice is that it will tolerate a certain amount of salt and at the same time produce income. Investigations which I carried out in Egypt show, however, that rice plays a definite part in the reclamation process.

If rice is not grown, the soil is impermeable owing to the presence of sodium hydroxide. The roots of the rice crop appear to generate carbon dioxide in the soil which converts the sodium hydro-oxide successfully into sodium carbonate and sodium bicarbonate. The soil in the presence ef sodium bicarbonate is again permeable. Leaching can be continued therefore and the sodium clay decomposed as the result of the hydrolysis which becomes a continuous process.

The land to be reclaimed is canalised and drained. Drainage is of the open drain type and the distance between drains about 120 feet during reclamation. The field drains are dug to a depth of 3 feet, the width at the bottom being 9 inches and at the top 36 inches. The unit of reclamation between drains is usually about two acres. In very stiff soils, the drains are closer together and one acre areas are the reclamation units. The land is flooded with water to a depth of 4 inches and kept under this head of water for sometime. At first percolation is rapid but the rate becomes gradually reduced. Just before the impermeable stage is reached, the land is dried, ploughed and a long growing period rice is sown. The further leaching of the land is then carried out under the rice crop. After one rice crop has been taken, the sodium clay is usually sufficiently hydrolysed to allow of berseem being grown. Two cuttings of berseem are taken and then the berseem is ploughed in as a green manure. If the berseem crop has been good, cotton is usually the following crop, the yield expected in Egypt being about 350 lbs. lint per acre. If the berseem crop has not been a success, it indicates that the hpdrolysis of the sodium clay has not been carried far enough and a further crop of rice is taken. This point may be decided after the first rice crop by examination of the soil in the laboratory.

It is essential for this type of reclamation that an efficient drainage system should be constructed and maintained. After

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CULTURE OF DECIDUOUS FRUITS IN PLAINS OF THE UNITED PROVINCES

1. The fruits known as *deciduous* are natives of temperate countries, but can be successfully grown in the plains of United Provinces with a little care. I am sure many an orchardist of our Province would ask me, the correct interpretation of the word "*deciduous*", so I would be failing in my duty, if I did not fully explain this word. The fruit trees according to their habits of growth and behaviour have been classified into several types like the ever-green trees, as the mango, litchi, loquat and citrus fruits; deciduous, that is those which completely shed their leaves during the resting period which is the whole of the winter in our province and start afresh in the spring like the peach, pear, apricot, apple and vines such as the grape.

It may be stated at the very outset that the list of fruits coming into the class "decidous" is a long one and all of them can not be grown in the plains of the United Provinces. Thus apples, apricots, almonds etc., cannot find a place in our orchards. The important deciduous fruits that can be grown in the plains are therefore, the peach, plum and pear.

2. *Soil.*—Needless to say, the deciduous fruits can be grown in almost any kind of soil, but the most suitable soil for growing these fruits is a light, sandy, and deep one containing plenty of organic matter and possessing the property of retaining moisture for a fairly long time.

3. *Preparation of Land.*—The land that is to receive fruit plants must be carefully cultivated so as to kill all weeds, specially the perennial ones like *Kans* (*Sacharum Spontaneum*) and *Doob* (*Cynodon dactylon*). These weeds do not allow the free penetration of roots in the soil and also check the free circulation of air and light which is very important. About four ploughings will make the soil fit and later pits $3 \times 3 \times 3$ should be dug at the right places.

4. *Propogation.*—The plum and the pear are commonly propagated by cuttings but it is wise to saddle-graft the choicest varieties, as the latter method of proportion brings in all the properties of the parent plant to the stock. The country plum raised by cutting serves as a good stock and the scion can be selected from the good varieties. The scion wood should be taken from last year's growth.

The peach is propagated by means of ring or tube-budding. The peach seed is sown in August, and germinates sometimes in the end of January or beginning of February. The growth is very

quick and some plants are ready for transplanting in about two months. The sturdy plants are transplanted in March and can be budded in the end of April or May. It may be said that the budding period varies according to the local climate and, there being a good deal of difference in weather conditions and temperature between say, Muzaffarnagar and Allahabad, the periods would not tally. Hence budding can be successfully done in April and May in Muzaffarnagar while at Allahabad the best time would be in September.

The peach seedlings at the time of budding should be about 18″ high and the stems about 1/8 inch thick. The top of the seedling is cut away and the bark is peeled off to a length of about 1½″ from the tip. A tube of about the same length and diameter is removed from the bark of the selected parent peach tree, and this tube is slipped on to the wood of the stock, until the two barks meet. The bark tube should have from 2 to 3 good eyes and should be tied round with raffia or banana fibre. Soon the bud start sprouting.

5. *Planting.*— The plants when ready should be planted in pits about 15 to 20 feet apart. The best time for planting deciduous trees is the winter when they have shed their leaves. At this time, planting can be done with the least possible risk and injury to the plant. The plants being dormant, start at once into new growth when the spring approaches without any setback due to transplanting. This does not mean that the monsoon season is an unsuitable one, but not as good as winter. The hexagonal system of planting will be the most suitable and will accommodate about 15 per cent more plants than the square system. An acre of land will need 155 plants at a distance of 18 feet each way.

6. *Cultural Operations.*—The plants till they have attained maturity *i.e.*, till they start bearing, should be carefully brought up. Manure should be applied at least twice in the year; once in the first week of January about a month before the actual flowering period and again in April when the fruits are developing. The deciduous fruit trees flourish neither in a very moist place nor in a dry place. They do need irrigation, but only from March to June, therefore an adequate, water supply must be available in these months to mature the fruits. After the trees have shed their leaves in December, the soil round about the trees (*thala*) should be dug by means of a spade and a fork and the soil loosened and pulverised. About two baskets-ful of manure should be added to each bearing tree and mixed well with soil. This should be done soon after the trees have been pruned. Later the trees should be kept clean and manured in April.

7. *Pruning.*—The first question an amateur gardener would ask me is "Why should we prune at all". The main object of pruning changes gradually with the development of the tree. For the first four or five years after planting the aim is to establish the main branch system of the tree. As soon as the tree is formed and has commenced to fruit, the maintenance of growth and prevention of over-cropping become of primary importance. The object of pruning is then to ensure sufficient vigour for the production of a healthy tree and heavy crops of large fruits throughout a long life.

The plant should have a fair height before pruning. The top should be shortened a little (more if weak, less if strong) and side soots are shortened to one bud, after which the tree should produce a number of good strong branches in the following summer. The branches which are in the right place should be assisted and those that are out of place or not vigorous should be pruned away.

The pruning of orchard trees should be done in the first week of January. In colder climates the practice is to prune heavily but in the plains of the U.P., the extent of pruning will depend on the weather and the temperature. The sub-mountainous tracts may adopt a fairly severe method of pruning while it should be confined to the minimum in warm and hot places like the central U.P. At Muzaffarnagar the pruning will consist of removing all the present year's branches leaving about 12 inches at the base. The part should contain from 6 to 8 healthy buds, which will form the basis of the next year's crop. Thus the bearing wood being of the last year's growth, all superfluous, dead and new shoots are removed, letting in as much of light and air as the plants need. At Allahabad the process will be slightly modified. The pruning will be confined to new shoots, leaving branches 18-24 inches long at the base, the top being cut off. This is due to the fact that in Muzaffarnagar where the *loo* (hot wind) blows from about 20th May to 20th June, there is less danger of the plant being damaged while at Allahabad with a longer period of *loo* and a higher temperature, great damage may be done to the plants, if the same method of severe pruning is adopted at Allahabad.

8. *Waterings*—The plants starts into new growth by about the middle of February and immediately after the flowers appear. After the fruits have set, water the plants carefully till the fruits have developed to their right size in May. This may take weekly irrigations in April and May and hence proper arrangements for the water supply should be made at this time which is most critical, the weather being hot and dry.

9. *Harvesting of Fruits.*—There are several varieties of peaches, plums and pears which mature at different periods. Imported varieties have also been introduced into the plains from

America and Japan, which do well in places like Muzaffarnagar and Saharanpur, but I am doubtful if they would survive at Allahabad or Lucknow. Of course the country varieties can be grown there also, but not so successfully. The fruit of the peach and plum ripens in early June, while pears mature in July and August. The fruits are picked, sorted and stored in a cool dry place, after which they are marketed.

The deciduous fruits make some excellent preserves, for example peach jam, plum jelly, etc. Apples and pears can be preserved as such.

The life of the deciduous trees is not a long one, being from 15-20 years. After an orchard is planted, it starts bearing in the fourth year and continues doing so till it gets old. The initial outlay is not so much as in the case of mangoes and litchis but the growing of deciduous trees is quite profitable for those orchardists who have little capital and want early returns.

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Fruit-grower and
Proprietor
The Anand Nursery, *Muzaffarnagar.*

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reclamation has been completed, the drainage system must still be maintained since areas in which salt has been present are always liable to resalting. The introduction of rice into the crop rotation once every four years may also be necessary to remove any salts that may have accumulated during the production of the other crops in the rotation.

5. *Application of sulphur as fertilizer.*—Sulphur used as a fertilizer, has been tried for the reclamation of alkali land in America and Egypt. The sulphur is oxidised to sulphuric acid by bacteria in the soil. The sulphuric acid thus produced assists in the hydrolysis of the sodium clay sodium sulphate being formed and removed by drainage. Reports indicate that the method is successful, but I have seen no account of the economic side of the treatment. The use of sulphur may be investigated later at Chakanwali Reclamation Farm.

From the point of view of the general farmer, the two most promising methods of reclamation are (3) and (4) the former being used on impermeable soils of land salt content, and the latter on salt soils. Drainage is essential to all methods of reclamation now being used. If the reclamation of kallar or alkaline soils is to be attempted, the construction of efficient drainage system in the reclamation areas will have to be considered.

THE MANUFACTURE OF INDIAN SWEETS

PART 3

BY N. R. JOSHI, I. D. D.

Syrup:—As the syrup from sugar is used in almost all of the sweets it would be essential that we know something about the preparation of syrup. Syrups of various consistencies are needed for different sweets aud hence we give below the preparations.

Take 100 lbs. of clean white sugar and put 25 lbs. of water in it. Take 25 lbs. of water in a separate vessel and add to it $3\frac{1}{4}$ lbs. of milk. Keep this mixture ready. Put your mixture of sugar and water on fire and allow it to boil. When the boiling begins add $\frac{1}{5}$ lbs. of the mixture of water and milk to the syrup. Some dirt will float on the top, remove this. Repeat the process at every boiling. By this time you have added your last instalment of the mixture of water and milk all the dirt from the syrup would have been removed. Now allow the syrup to boil till it has reach the consistency you want.

SYRUP A.—Just after the last boiling remove it from the fire.

SYRUP B.—Prolong the boiling for some time, then determine the consistency by the following list:
Take a drop of syrup on your index finger and gently press your thumb on it and remove the thumb if it gives out one fine string, romove it from the fire.

SYRUP C.—The same as above till you get the consistency of two strings.

SYRUP D.—The same as above till you get the consistency of three or more fine strings.

SYRUP E.—Increase the consistency by prolonged boiling as above till you get several strings but slightly thicker than the last ones. This is known in Hindi as KAPASI.

SYRUP F.—As above but the threads are thicker than the last one. This is known as GUCHHEDAR.

SYRUP G.—The threads in this are thicker than the last ones but when the threads are broaden the syrup forms into a small ball. This is known as GOLIDAR.

Preparation of Khowa:—Khowa which forms a sort of hase in most of the sweets is prepared in this following manner:

According to the capacity of the Kadahi (around bottomed frying pan) take 10, 20 lbs. of milk and put it on the fire. Allow it to boil, keep stirring so that the milk solids do not get charred at the bottom otherwise this would impart a burnt flavour to the khowa.

When the milk begins thickening lesson the fire slightly but keep the milk stirring all the time. Keep it on the fire till most of the moisture is dried out from the milk, and you get a solid mass which would retain its shape when rolled into a ball. If it is heated too much it would become very dry aud crumbly. Texture is affected very badly. Usually from buffaloes milk one should expect 4-5 chattacks of khoya from one seer of milk.

Composition of khowa:—Roughly in khoya you find 30 per cent fat, 40 per cent moisture and 30 per cent other solids—notfat.

Preparation of Sugars for Sweets

In order to have the proper texture of sugar to be added into different sweets ordinary bazar sugar is reutilized at different consistances of the syrup, also it helps in removing the extraneous dirt from the sugar.

I. Preparation of Bura.—Prepare the syrup as noted when the syrup has become of F type Take down the vessel from the fire and keep pounding with a pestle. When it is thoroughly dried up strain with a sieve.

II. Preparation of Rava.—Prepare the syrup as described. When the syrup has E become of G type take it down from the fire. Keep scraping the sides with a scraper. When dried up thoroughly, strain with a sieve of larger holes than the above one.

III. Preparation of Kand.—Prepare syrup. When the syrup is of C type take it down from the fire. Keep it stirring with a ladle. When the syrup begins to crystalise, take the syrup down on a piece of cloth. Tie it and keep it over night. When it is thoroughly dried up, scrape up everything and keep in a clean vessel.

Preparation of Peda.—No. 1. Take one pound of khowa and put it on a slow fire in a frying pan. Roast it till it is brown in colour. Then add one pound of Kand and take it down from the fire. With a wooden pestle mix it thoroughly. When it is mixed up thoroughly and sufficiently cooled, add couple of drops of desired scent. Roll the pedas. Size as desired. Pistas are sometime put on the pedas.

Prepration No. 2.—Take one pound of khowa and put it on the fire. When becomes hot add 2 pounds of bura. It will begin boiling. Keep stirring and then take it down after boiling for sometime. When the mixture starts cooling down, knead it thoroughly with a wooden pestle. Add some essence if desired. Roll into pedas of any size desired.

Preparation of Burfi.—Take 5 seers of sugar and prepare

syrup from it of F type. When the syrup is ready take it down from the fire and add to it 4 seers of fresh clean khowa and mix it thoroughly. Keep mixing with a scraper. When it is cooled down add some essence. Take it down on a dish and spread it evenly, sprinkle some pistas and chiraunji When it is set firm enough, cut it with a knife into small cubes and arrange in a dish.

Kalakand.—Take 1 seer of clean fresh khowa and add to it 1 seer of "rava". Mix the whole thing thoroughly, spread it evenly on a board and paste some silver paper on it. Cut it into small cubes when set.

Burfi from Oranges.—Take a few large oranges enough togive you about 1 pound of orange pulp. Remove the rind and then put of the skin from the sections and also remove the seeds. If you have taken 1 pound of orange pulp take three pounds of milk and put it on the fire and allow it to boil. While boiling keep stirring so that it may not get changed at the bottom. When the milk is boiled down to roughly half it volume add the orange pulp to it and keep boiling and at the same time stirring it thoroughly. When the whole mass has become of the consistency of khowa remove it from the fire. Now prepare syrup of F type. When the syrup is ready put into it the orange khowa and mix it thoroughly. After mixing it well put it on the fire for 5 minutes and then take it down and pour it in a dish. Paste some silver paper. When it is well set on sufficiently cooled down, cut it into small cubes and arrange them in a plate.

Almond Burfi.—Take one pound of almond seeds and soak them in water. When the skin swells up after soaking, peel it off. Grind up well in a mortar with a pestle. Now mix in it equal quantity of khowa and bake the whole mixture on a slow fire till it gets slightly brownish. Now prepare syrup of F type from two pounds of sugar. When the syrup is of right consistency remove it from the fire and scrape it well from the sides. Now put your almond mixture in it and also add a few drops of some essence and mix it thoroughly and pour it in a dish. Paste some silver paper. When it is cooled down and set, cut it into small cubes and arrange them in a dish.

Rabadi Preparation.—There are two preparations of Rabadi One is known as Lacchedar and the other a ghoti.

Lacchedar.—Take four seers of milk in a kadahi and put it on the fire. When the milk begins to boil lessen the fire. The thick creamy scum will form on the top, remove it to one side of the kadahi. Now start fanning the milk from the top and you would get a second layer of this creamy scum put it aside. Repeat this till the milk is sufficiently thickened and you do not get any

more layer of creamy scum. Take it down from the fire, then add half a seer of bura and mix it with a scraper. When it is cooled down add a few drops of some essence and spread over the milk the layers of the creamy scum which you have got, add 1 oz. of pista cut into small pieces.

Ghoti Rabadi.—Take four seers of milk in a kadahi and put it on the fire, when it begins to boil slow down the fire. Keep stirring when the milk becomes sufficiently thick, take it down from the fire and add half seer of bura. When it is sufficiently cooled down add some essence or if it is to be slightly coloured add saffaran. Add some nutmeg ($\frac{1}{4}$) 1 oz. pistas cut into small pieces and 2 ozs. of chirauji.

Preparation of Malai.—Take four seers of milk in kadahi and put it on the fire. Whenit begins to boil take it down from the fire. Now put a flat bottomed shallow pan on a slow fire and put some milk into it. The balance of the milk should be transferred from one vessel into another at a force so that foam forms on the top. Remove this foam with a big spoon and put it on the flat bottomed pan. Keep taking out the layer foam like this from your milk and transfer them to the pan on the fire. When the foam settle into firm layers take it down from the fire. In case the layers begin to swell lessen the fire. Transfer when ready from a pan to a clean dish.

Rasgulla.—Take one seer of khowa and mix in it $\frac{1}{4}$ seer of arrowroot floor and $\frac{1}{2}$ ounce cardamom powder. Mix the whole thing thoroughly with a $\frac{1}{4}$ seer of water. Knead thoroughly and make into small balls of oval or round shape. Prepare sufficient syrup of B. Take ghee in a kadahi and put it on the fire. When it is heated up put the rolled balls into the ghee. Keep stirring so that they may be baked all round. When they become sufficiently brown take them out and put them in the syrup for one seer Khowa three seers sugar syrup would be sufficient.

Poori from Malai:—Take four seers of good clean milk and put it on the fire. Boil it down to $11\frac{1}{3}$ seers. Then take four ounces of arrowroot flour and mix it thoroughly in milk. Take some ghee in a frying pan and put it on the fire; when it is sufficient ly hot pour with a spoon some milk paste that you have prepared in ghee, of the size of an ordinary puri. Turn it around and see that it is well fired but remove it from the frying pan before it becomes reddish in colour; put this puri in syrup of A type. When it has soaked enough of syrup remove it put it on a dish and sprinkle with some pistas.

NOTE:—(*i*) If the rasgullas dimple after putting into the syrup it indicates that the frying has been done at a very high temperature in that case reduce the fire.

(*ii*) If the fire is very slow the rasgullas would break while frying.

Preparation No 2.—If preparation of rabadi is not possible take one seer khowa and mix in it four ounces of arrowroot flour, add sufficient water to make it into a thin paste. Then proceed as above.

Gaja from Khowa:—Take one seer of fresh clean khowa and put it on the fire in a clean vessel. Bake it well till it becomes slightly brownish. When it has become brown add ½ seer of kand and take it down from the fire. Knead it well with a pestle. Add some cardamom powder, now take it down on a flat board and spread it evenly. When it is well set put some silver paper on it and cut it in long thin strips and arrange in a dish.

Gojhia from Khowa:—

Laddu (sweet balls) from Chana:—Take four seers of fresh cow's milk and put it on the fire. When it starts boiling take it down and add some alum water. This will hasten the precipitation of milk solids. Allow the curd to be in the whey for about 15 minutes. Then drain the whey off and put the curd in a muslin cloth. Allow some more whey to drain off. Then take it down and put the curd into a mortar and break all the clods with the pestle. Keep powdering till you get a very uniform paste with hemps. Prepare syrup of B type and keep ready. Now take some ghee in a frying pan and put it on fire, when the ghee is sufficiently hot take a perforated ladle and put a little of your paste on it strike the laddle against the kadahi when the paste will ooze into the ghee in small drops. If the drops fry well without breaking it is all right but if they happen to flatten or break into small pieces add two ounce of flour to the paste. When the drops are all thoroughly baked in ghee take them out and put them in the syrup. Soak them well in the syrup for half an hour and then take them out. When they are cooled down roll into small balls. Essence may be added to the syrup if desired.

Gulabjamun. Take one seer khowa add to it ⅓ seer of flour, ½ oz. soda and 7 ozs. of water. Mix the whole thoroughly and roll into small balls either round or oval. Then take some ghee in a Kadahi and put it on the fire. When it is sufficiently hot put the balls into it and bake them well. When the balls have become of reddish tinge all over remove them and put into the syrup of B type. If the balls begin to break when frying increase the fire. If they happen to break even than add about 4 ozs. of flour to the mixture. In case the *gulabjamuns* become very stiff put them along with the syrup on the fire and allow the syrup to boil well.

Kalajamun.—Take one seer of "chena" and add to it 8 ozs of "Rava" sugar and eight ounces of flour and mix the whole thoroughly. Now prepare syrup of B type and ready. Take some ghee put it on the fire. When it is sufficiently hot, put a ball rolled from

the chena mixture either round or oval into the ghee. When it is baked well from all sides and become reddish in tinge remove it and put it in the syrup.

Lalmohan.—Take one seer of fresh khoya and add to it one seer of chena. Mix it thoroughly with four ozs. of water. It should be kneaded well so that no lump is left behind. The whole mass should be of a smooth, velvety consistency. Then keep ready some syrup of A type. Now put some ghee in a pan on the fire and when it is sufficiently hot put a ball rolled from your khowa and chena mixture into the ghee. Bake it well from all sides, control the fire; if the fire is too strong the ball will dimple when you put into the syrup. In too slow a fire it will break.

Balusahi from Chena.—Take one seer of chena and add to it four ounces of suji. Mix it thoroughly so that no lumps are left in the mixture. Then roll into balls, flatten at the ends with your palms. Now prepare syrup of A type from three seers of sugar. When the syrup is of desired consistency put your balls into the syrup and allow the syrup to boil. When the syrup starts thickening add ½ seer of water to it. If you find that the balls are breaking lessen your fire. When the balls becomes a brownish colour and when the syrup is thickening take it down from the fire.

Chandrakala.—Take ½ seer fresh khowa, two ounces scraped pistas, two dram cardamoms, four ounces chironji, two ounces cocoanut scrapings and ½ pound sugar; mix these things thoroughly and keep them. Take one seer flour and add to it six ounces of ghee: add water and knead the flour thoroughly. Take a little and flatten it on a board like "Puri". Put a little mixture of khowa in it and close it down from all sides. Make any desired size and shape.

Now take some ghee in a pan and put it on the fire. When it is sufficiently hot put the "chandrakala" in it and fry it well. Take care that it is baked well from all sides.

Now keep some syrup of B type ready and put the fried "chandrakala" into it. When the chandrakala has soaked sufficient syrup remove it and put in a dish and sprinkle some pista scraping.

Mohan Bhog.—Take half a seer of good white marrow and peel it off remove all the seeds and cut it into very small pieces. Wash it thoroughly with water changing the water two or three times.

Now take four seers of milk and put it on the fire. When the milk become sufficiently thick add to it the pieces of white marrow and four ounces of chironji, two ounces of pistas, two ounces scraping of cocoanut, two ounces of raisins, two drams cardamom and four ounces of sugar. Mix the whole thing thoroughly and keep scraping with a scraper: when it is sufficiently thick remove it and put it in a dish.

SOME INSECTS ATTACKING CITRUS FRUITS AND METHODS OF CONTROL

By W.B. Hayes (Horticulturist)

And W.K. Wesley (Entomologist)

In the development of fruit growing in the United Provinces, which is just beginning, the orange and other citrus fruits are bound to play an important part. They are already grown in small quantities in all parts of the province. In the neighbouring provinces the citrus industry is already of some importance. In the Central Provinces the Santra orange has long been grown in large quantities around Nagpur and other centres, while in the more recent developments in the Punjab both the Santara and the tight-skinned Malta type orange and other citrus fruits have been planted.

Climatic and soil conditions in much of the U. P. are very favourable to the different citrus fruits. Much remains to be learned about the best varieties, and the best cultural methods, but there can be no doubt that excellent results can be obtained. Among the more serious problems facing this industry is undoubtedly that of controlling the insects and diseases which attack this group of fruits. These fruits are grown in many parts of the world, and everywhere they enjoy great popularity among the insects and fungi. In this respect India is no exception, although the pest problem is not as great here as in some countries. It is the purpose of this article to record the insects attacking citrus trees at the Allahabad Agricultural Institute, and to suggest remedies.

These observations have been made largely on young citrus trees planted at the Institute within the last three years. These include different varieties of the sweet orange (the Malta type), the loose-skinned oranges including the Santara, the tangerine and the Japanese oranges, the lime, the lemon, the grapefruit, the pomelo and the kumquat. Most of the insects attacked all of these fruits indiscriminately. Instances of insects attacking only one kind will be mentioned; otherwise it is to be assumed that all kinds suffer.

Insects attack all parts of the citrus plant, but the most common are those found on the leaves, either eating the leaf or sucking its juice.

One of the most common insect pests is the caterpillar of the lemon butterfly. The damage caused by it on young plants is often very conspicuous. Nursery stock is soon defoliated if the caterpillars are allowed to feed on it, and a serious loss of leaves may be experienced with young trees in the orchard. On older trees the

damage is less severe, and this may be considered a minor pest of old trees. The lemon butterfly belongs to the genus Papilio, several species of which are pests of crop plants. Those found in Allahabad were P. demoleus and P. polytes. In other countries P. cresophontes and P. demodocus, both called the organe-dog, are reported causing very similar injury on citrus plants.

Papilio demoleus is the worst leaf-eating pest of Citrus trees and is found all over the United Provinces throughout the year. Besides Citrus, it also occurs on Bael (Aegle marmelos). The butterfly is readily seen actively flying about on worm, suuny days but even in winter it does not escape our eye. It is easily recognised by its large size (wing expanse—3"), bluish-green colour with ornamental yellow spots and two eye-like marks on the hind wings.

The female butterfly deposits her small, (dia—1 mm.) round, smooth, pale eggs singly, generally on the undersurface of the young leaves and growing tips. The butterfly while flittering about a plant stops over a leaf for a short time, bends her abdomen with its tip towards the lower surface of the leaf and lays an egg. The egg hatches within about three days in summer and a week in winter. Sometimes the empty egg shells may be found but as a rule they are not because the tiny caterpillar eats its way out of the egg shells and then feeds exclusively on the Citrus leaves. During its younger stages the colour of the caterpillar is a curious blend of black and white—a colour protective device—making it look like the droppings of birds on the leaves. As maturity is reached the colour scheme changes and the caterpillar becomes green with a few oblique brownish stripes down the sides of the body making it to harmonize with its surroundings. When disturbed the caterpillar throws out a forked flesh-coloured structure just behind the head and at the same time produces a spray of some volatile sweet smelling substance to frighten away its enemy. The caterpillars are full-fed in two weeks in summer and four weeks in winter and are ready to pupate. The pupation may take place away from the food plant but usually it takes place on the food plant. Before changing into pupa the caterpillar suspends itself by a girdle of silk-thread. Greenish or black spotted straw-coloured pupas are suspended from a twig or the branch of a neighbouring tree in a very interesting manner. The pointed end is fixed by means of hooks in a little heap of spun silk and the weight of the body is supported by this silk girdle which passes round the body. The pupal stage lasts for a week in summer and up to twelve weeks in winter is thus passed in the pupal stage and the butterflies from these over-wintering pupa come out in the months March and April and start procreation.

Control.—The most convenient method (when the number is small) to deal with this pest is to hand-pick the eggs and the caterpillars and drop them in kerosinised water. In places where the caterpillars have become very numerous and hand-picking is difficult the plants should be either dusted with Paris green mixed with ashes in the ratio 1:8 or sprayed with lead arsenate mixed with lime as follows:

Lead arsenate	3 ozs.
Lime	3 ozs.
Water	4 gallons.

The butterflies can be caught in hand nets and destroyed.

Garden lizards should be encouraged for they destroy a good many of them.

Another insect attacking the young leaves is the orange leaf caterpillar, Tonica Zizyphi. The damage done is not as great as that caused by the lemon butterfly. Young shoots are sometimes denuded and fall. The pest may require treatment on young trees, but is not likely to be serious on old trees.

Tonica zizyphi is the caterpillar of a small moth (with expanse —1·2 mm.).

The eggs were not observed. The caterpillars are long, slender yellowish-green with very dark-brown heads and measure about 8 mm. in length when full-fed. They fold orange leaves longitudinally, feeding on the young leaves. Pupation takes place inside these folded leaves. The pupa is enclosed in a cocoon of almost white silk. It is about 7 mm. in length and reddish-brown in colour. The pupal stage lasts for about four to five days in summer and twenty to twenty five days in winter.

Handpicking of caterpillars in the folded leaves is profitable when the number is small. When the infestation is very heavy, fumigation of these plants with Hydrocyanic acid gas should be tried.

The orange hairstreak, Tarucus theophrastus, has also been found, but in very small numbers. It also eats the tender leaves, and if it became plentiful might prove a serious pest.

Tarcus theophrastus is a small butterfly (wing expanse—2·5 c.m.) whose caterpillars feed on Ber (Zizyphus jujuba) leaves. These flat, green caterpillars are often seen on citrus plants eating the leaves. They do not cause much damage.

Hand-picking of these caterpillars and their subsequent destruction will eliminate them in no time. The destruction of wild ber trees round about will help control this insect.

The orange leaf miner, Phyllocnistis citrella, is present in fairly large numbers, but the damage done is not great. The minute larvae make mines beneath the epidermis of young leaves. This causes the leaves to curl slightly, giving the tree a somewhat unhealthy appearance. The harm done is not sufficient to justify control measures.

Phyllocnistis citrella is the caterpillar of a very small silvery white moth (wing expanse—1·28 mm.) which is a prolific breeder.

The eggs are small, more or less transparent and flattened and very difficult to detect. They are laid on the leaf or green part of tho shoot and hatch out within three to ten days. The larvae on hatching work their way under the epidermis and feed on the green tissue of the leaf, leaving the thin epidermis intact. The caterpillars are tiny little creatures and when full-grown, they measure only about 3·5 mm. in length. They are pale-yellow or pale-green and almost transparent with light brown mandibles. These caterpillars are almost legless and move in the mines by means of wriggling movements. The larval stage lasts for about five days in summer to twenty-five days in winter. At the close of the larval stage the caterpillar pupates at the extremity of the gallery encloses in a light silken cocoon. The pupal stage lasts for about five days in summer and twentyfive days in winter.

Though the damage caused is small with the big trees, it is quite considerable in the case of the young citrus plants.

The pruning of these plants in December and January or spraying them with crude oil emulsion in February may be tried. In case of very heavy infestation, fumigation of these plants with Hydrocyanic acid gas should be carried on. Citrus hedges round the citrus plantation should be avoided. Bael (Aegle Marmelos) being the alternative food-plant should not be allowed to grow near the citrus orchards.

The orange aphis, Toxoptera aurantii, has made sporadic attacks, but has not been a serious pest. Like the previous pests, it attacks all of the citrus fruits, sucking the sap from the tender leaves. It is rather easily controlled with tobacco water.

Two types of scale insects have been noted. One of these was found on one plant only, and was probably on the plant when it was purchased from the nursery. This plant was labelled'Dominican Spineless lime', but this may be a misnomer. The insects were removed by hand. The other type of scale has been found on a number of young pomelo plants. It occurs on the stem, especially around the buds, and seems to cause contortion of the young shoots. These scale insects have not yet been definitely identified. Scale insects are of very great importance in many citrus growing regions. There are a large number of them, and they cause great

damage. They are difficult to control. Fumigation with hydrocyanic acid gas is a common control measure, but is very expensive. A few adults of Citrus Psylla (Diaphorina citri) were observed in February. They are small sucking insects about 2 mm. in length from the vertex to the tip of the abdomen.

The insecticides which have proved most effective are tobacco decoction and soap emulsion.

Every effort should be made to keep India free from these severe pests.

Only one type of insect injury to citrus fruits has been noted, that caused by the orange fruit borer. Ophideres spp. Both types of orange are attacked. The adult moth thrusts its proboscis into the ripening fruit and sucks out the juice. Decay starts around the wound, and in a few days the fruit falls to the ground. This is sometimes a source of serious loss. No very satisfactory control measure is known. Enclosing the fruits in muslin bags is said to be effective, but is an expensive and bothersome method. The number of moths may be reduced by eliminating the hosts of the larval stage, which are wild creepers.

A RECIPE FOR DESTROYING BLACK ANTS.*

Sugar 12 lbs; tartaric acid (crystallized), $\frac{1}{4}$ oz; benzoate of soda, $\frac{1}{4}$ oz; water, 10 pints; and honey (strained), 2 lbs; arsenite of soda (pure), $\frac{3}{4}$ oz; water, one pint.

Warm the 10 pints of water and in it dissolve the tartaric acid, benzoate of soda, and the sugar. Boil slowly for half an hour and then add a little more water to make up for that lost during the boiling. Dissolve the arsenite of soda in one pint of hot water, and when the two solutions have nearly cooled, stir them thoroughly together and add the honey. This poison is very weak, so that it does not kill the ants on the spot, but is taken down by them into their nests and fed to the young. In this way it gradually kills out the whole nest.

"A watch without hands won't tell the time of day

A farmer without accounts doesn't know where he gets his pay."

THE AGRICULTURAL STUDENT
COLLEGE OF AGRICULTURE
OHIO STATE UNIVERSITY.

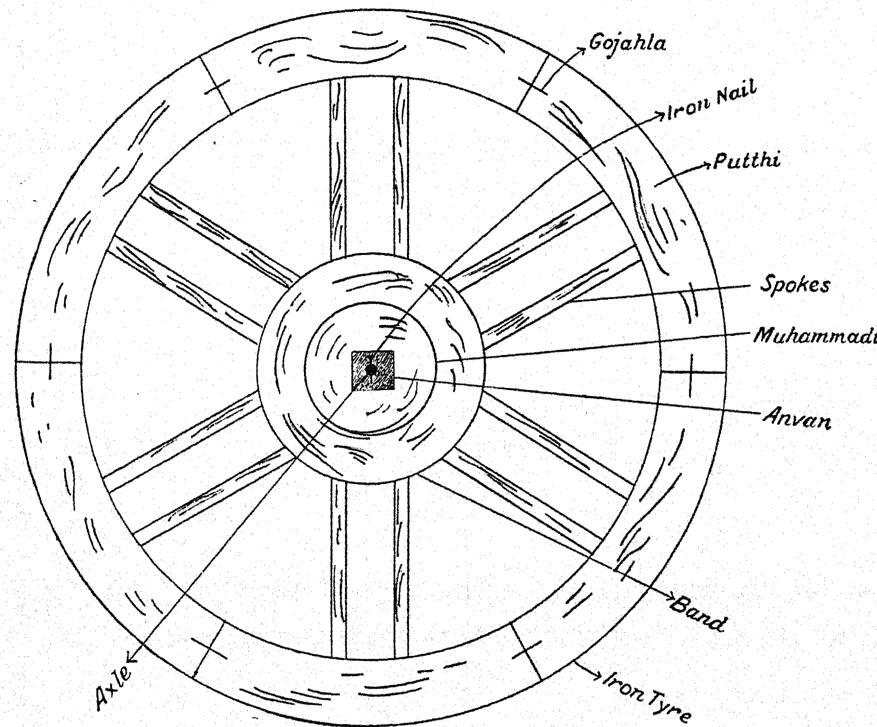
*Taken from the "Indian Forester," a reprint from "Farming in South Africa".

THE BULLOCK CART: ITS DIFFERENT PARTS AND THEIR DESCRIPTION

By Sarasmati Prasad, Lecturer, Department of Economics, University of Allahabad.

Two rectangular logs of wood, (called *Phar* in Hindustani) each nearly twelve feet long, having all its four sides smooth and plain, marked A A, A A′ in the accompanying diagram, diverging towards the hind portion of the cart and converging towards the front, are first fixed in this position by iron nails passed through wooden cylinders between two pairs of rectangular beams of wood (called *Sujwa and lakh ki patri* in Hindustani). The front *Sujwa* passes under the *Phar* and measures nearly 7½ feet long by 2½″, and 4″, and the hind one passes over the *Phar* and measure 7½ feet long × 2½″ and 4″ marked B B and B′ B′ in the diagram. These *Sujwas* have rounded rod-like ends which are fitted into sockets made for them in the *Panjanis* marked C C and C′ C′ in the diagram. The *Panjani* is a crescent shaped piece of thick wood, measuring 8¼ feet × 9″ × 2½″ nearly, generally of *babool* and sometimes of *Sakhoo* or teak wood. Between the *Phar* and *Panjani* on each side is a wheel which is prevented from flying out by the *Panjani*. In the middle of each *Panjani* is fixed an iron axle weighing nearly 7½ seers, marked D D in the diagram, which passes through the centre of the wheel into the *ankh* or *Nasahodi*, (marked E E in the diagram), which is a wooden attachment to the lower surface of the *Phara* in its middle. This attachment consists of two rectangular blocks of wood, measuring nearly two feet long and three inches broad, thicker at the hind end and thinner at the front end. On its inner side the *Phar* rests on it and on the outer side of it a piece of rectangular wood rests on it. These two blocks of wood are joined at both ends by two pieces of wood as shown in the sketch. (figure 1). The *Nasahudi* and the *Phar* are fixed together near each end by an iron nail. Through an (iron eye figure 2) fixed in the *Phar* a nail is passed to fix the upper piece of wood to the *Nasahuri* near each end. On the inner side of the *Nasahudi* the axle is passed through an iron disc against which rubs a nail passed through a hole near the inner end of the axle. In some carts on the outer side of the *Nasahudi* also, the axle is made to pass through such an iron disc. To an iron *Kharkharia* or hook, (figure 3) fixed in the *Sujwa*, the *Panjani* is firmly tied by a rope called *Junth*. Above the *Phar* 18 wooden rectangular blocks called *Patris*, are fixed parallel to the *Sujwa*. Two round beams of wood called *Bangar* are then fixed above these *Patris* parellel to the *Phar*. Below the hindmost *Patri* are fixed two vertical rods of wood, called *Ularwa*, in

order to prevent the hind part of the cart from touching the ground at any inconvenient moment.



In the front part of the cart a thick plank of wood, tapering at the front end and broad at the hind end, called a *Sugani*, is fixed horizantally between the two *Phars* (figure 4). Another crooked piece of wood, called *Untra* (gure 5) is placed below the *Sugni* and is nailed on to the wooden *thapra* (figure 6) which is placed above the *Sugni* to prevent the *Juwa* from sliding backwards (figure 7). The *Juwa*, to which the bullocks are yoked, is firmly fixed in a horizontal position parallel to the *Sujwa* with iron wire and ropes passing around its middle and fixing it firmly to the *Sujwa* and the *Lakh ki Patri*. At the front end of the cart are fixed two movable wooden rods, called *Sipawas*, which hold up the cart in a level positition when so desired. There are two wooden nails (figure 8) called *Sailas*, which hang through 2 holes at each end of the *Juwa*. Between these nails the bullocks are yoked by ropes in some carts and by a leather strap in others. In order to strengthen the *Phar* thin iron strips are fixed on each side of it in many carts. *The Wheel.* The rim is made of six *puthis* or pieces of *babool* wood four inches thick and ten inches broad. They are joined to each other by

means of woodon rods, (called *Gojahla*), which are hammered into the sockets made for them in these arcs. Each pair of opposite arcs is joined together by a pair of parallel spokes passing through holes acrss a solid wooden cylinder at the wheel. A hollow square is scooped out at the centre of this wooden cylinder and in this square space an iron anvil-like piece, (called an *Anvan*) weighing nearly 5 seers each), with a hole in the middle, is fitted on both the top and the bottom, or on each of the two surfaces of the cylinder. Through this hole the axle passes. Into this wooden cylinder, round each *anvan*, at a short distance is insert a thin and narrow iron circular band called a *Muhammadi* weighing nearly 5 seers. Each end of this cylinder is enclosed by a circular iron band called a *band* (each weighing 2½ seers nearly). Towards its outer end there is a hole in the axle through which a nail, resting against an iron or jute disc, is vertically passed so as to prevent the axle from leaving the wheel. Finally an iron tyre, weighing nearly a maund, runs around the wheel.

Schedule I.

Name of Part	Number	Price	Length of Life		Annual Depreciation	Repairs
			Years	Months		
		Rs. a. p.			Rs. a. p.	Rs. a. p.
Sugni ..	one	1 0 0	16	0	0 1 0*	
Thapra ..	one	0 4 0	2	0	0 2 0	
Untra ..	one	1 0 0	5	0	0 3 3*	
Saila ..	two	0 2 0	0	6	0 4 0	
Phar .	two	20 0 0	15	0	1 5 4*	
Painjni .	two	7 0 0	7	0	1 0 0*	
Jooa ..	one	2 0 0	4	0	0 8 0*	
Nasanhri ..	two	6 0 0	12	0	0 8 0*	
Sujwa	two	6 0 0	8	0	0 12 0*	
Lakh ki Patri ..	two	1 8 0	2	0	0 12 0*	*
Kharkharia ..	four	0 6 6	13	0	0 0 6	
Bagar ..	two	1 8 0	6	0	0 4 0*	
Ularua ..	two	0 2 0	1	0	0 2 0	
Sipawa ..	two	0 2 0	1	0	0 2 0	

* Average Annual repairing charges of Parts marked with an asterisk comes to Rs. 15.

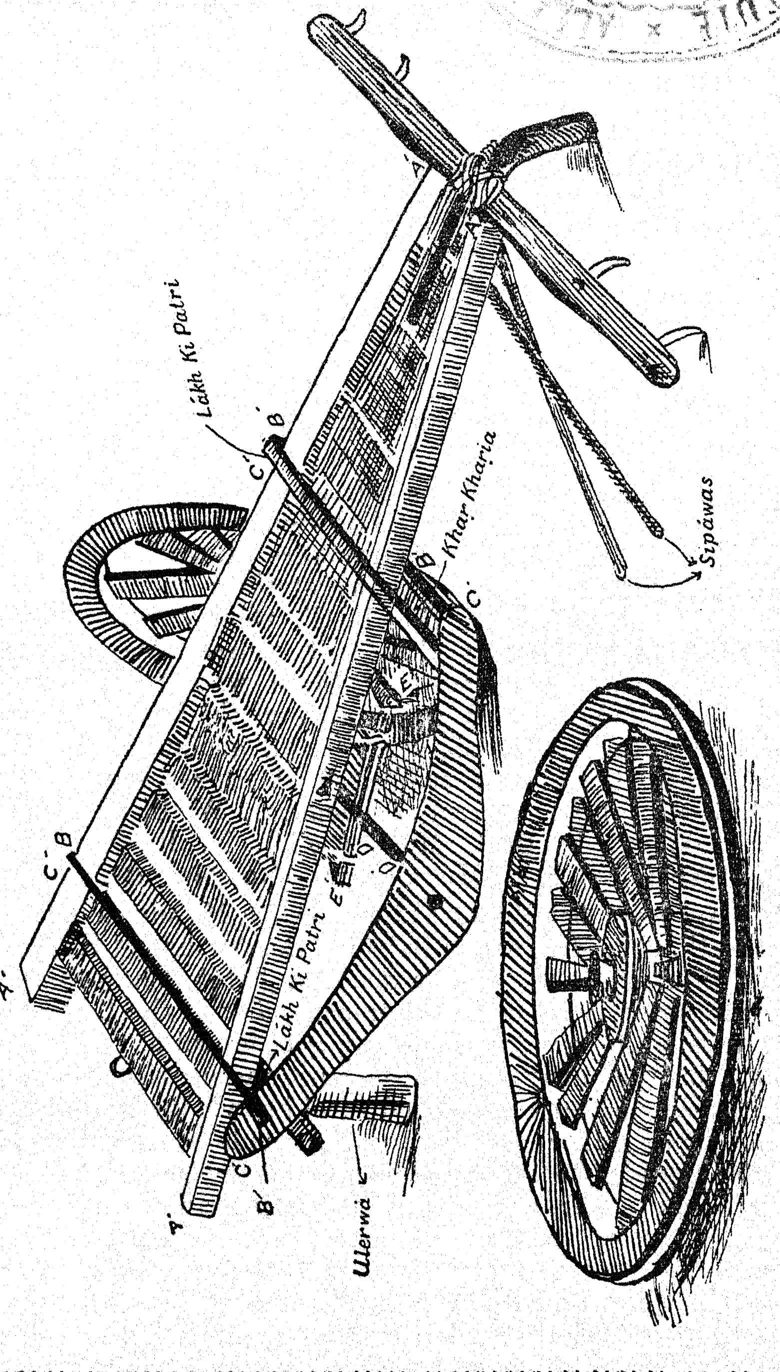
Name of Part	Number	Price	Length of Life		Annual Depreciation	Repairs
			Years	Months		
		Rs. a. p.			Rs. a. p.	Rs. a. p.
Wheels ..	two	30 0 0	6	0	5 0 0	
Iron Tyres .	two	18 0 0	3	0	6 0 0	Re-tyring 16 0 0
Axles ..	two	3 8 0	2	0	1 12 0	
Muhammadi .	four	1 0 0	16	0	0 1 0	
Anvan	four	4 0 0	1	0	4 0 0	
Band ..	four	2 8 0	12	0	0 3 4	
Khoontey ki Patri	five	3 0 0	12	0	0 4 0*	
Bharao ki Patri ..	eighteen	4 8 0	9	0	0 8 0*	
Ropes ..	four	2 8 0	0	2½	12 0 0	
Pegs .	twelve	0 12 0	0	9	1 0 0	
Iron Plate Strips ..		3 0 0	6	0	0 8 0	
Nails .		1 0 0	16	0	0 1 0	
Bhainsas or he-buffaloes .	three	100 0 0	8	0	12 8 0	
Shed with feeding and drinking troughs.	one	60 0 0	20	0	3 0 0	
Lash ..	one	0 2 0	0	1	1 8 0	15 0 0
Total .		..	.	..	54 5 5	31 0 0

*Average Annual repairing charges of Parts marked with an asterisk comes to Rs. 15

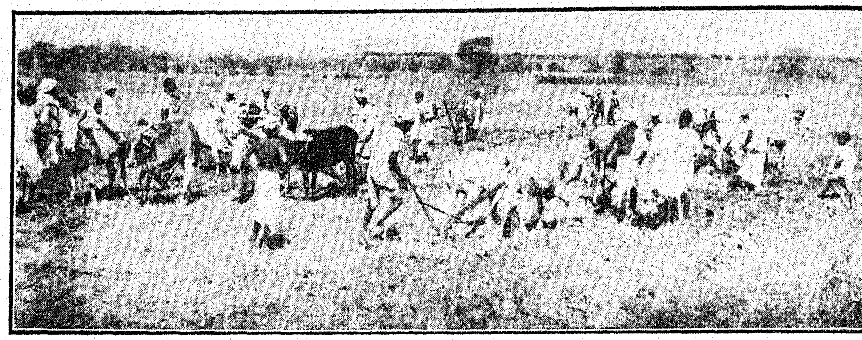
N.B.—(1) The prices and lengths of life given this schedule are the average of a number of figures obtained from owners, drivers, builders, repairers and agents.

(ii) Parts which needed repairs frequently have been marked with an asterisk in this schedule in column No. 5. The annual expenditure on this head varied from Rs. 12 to Rs. 25 and an average annual expenditure of Rs. 15 has been taken in this calculation.

(iii) Adding up the prices of different parts, the total cost of a bullock cart comes to Rs. 120-12-0.


Lākh Ki Patri
Khar Kharia
Sipāwas
Lākh Ki Patri
Ullerwā

ALLAHABAD FARMERS' FAIR 1934



The Fourth Annual Farmers' Fair was held on the college farm of the Allahabad Agricultural Institute from the 7th to the 10th March.

In connection with the fair a refresher course was instituted for the Agricultural and Rural Knowledge teachers, which was started on the 5th March. There were altogether 69 teachers who registered for the course; many of them were sent by the Educational Department of the U. P. Government. Although this was the first time that the short course was started, yet it proved very successful as most of these who came were bent on using their four or five days' stay at the Institute Farm to their best advantage. The classes were all conducted in Hindustani. Amongst those who conducted the classes were Messrs. W. H. Wiser, Ph.D. (Rural Economics), W. B. Hayes, M.Sc. (Horticulture), C. P. Dutt, M.Sc. (Soils), N. R. Joshi, I.D.D. (Animal Husbandry), S. R. Misra (Farm Management), and others.

The Fair was officially opened on the 7th March in the evening by the Hon'ble Mr. Justice Bajpai of the Allahabad High Court. The chief speaker of the evening was Rai Sahib Chawdhari Hari Ram Singh, formerly agricultural propagandist of the U.P. Government. The meeting was attended by a good crowd of the citizens of Allahabad, by the cultivators of the surrounding villages and the visiting teachers of agriculture and rural knowledge in Government Schools. The speaker of the evening made a very impressive speech and appealed to the farmers to adopt the scientific methods of farming and to start co-operative marketing and banking. Following the speaker moving pictures were shown showing the activity of the cow in converting plant food into milk fit for consumption and showing also the use of large ploughs pulled by tractors. After the pictures, the students of the Institute presented a drama, written, staged and acted by themselves depicting aspects of the problem of untouchability.

The exhibition officially started the next day. Amongst the exhibits were shown the various fans, baskets, needle-work, rugs, carpets, etc., which were made by the women of the vicinity. These exhibits attracted a large crowd of ladies from Allahabad and the neighbouring villages. One fan which attracted the most attention was constructed entirely of paddy grains.

In the adjoining room of the College building where these exhibits were displayed was a collection of placards, baby dolls under mosquito-nets, sanitary devices, all of which were meant to teach the villagers the value of hygiene and sanitation.

The crop exhibits had the largest collections, amongst which were shown the improved varieties of wheat, barley, oats, gram, etc., most of which are grown at the Institute farm.

The plant pathology department also put up some of the most common diseases attacking the crops in the U. P., such as the rusts of wheat and barley, the smuts of *bajra* and barley, the white rust of mustard, the canker of lemons and limes, the red-rot of sugarcane, the mosaic diseases of sugarcane and potato, the mildews of cucurbits, etc.

In the Zoology and Entomology section there were exhibits of various animal specimens of the fœtus of a cow and various insect pests including butterflies of all colours and designs. Amongst the insect pests that were displayed were the aphides or green flies which attack mustard and various other crops, the cucumber beetle, the cutworm which attacks young plants, stem borers, and various beetles and caterpillars most of which are such great enemies to the farmers.

The Chemistry department had an interesting display of commercial products made by students in the chemistry laboratory and one very interesting poster showing the variety of commercial products which might be made from coal.

The soils department had on display all types of soils found in the province and the adjacent parts. The white incrustations of alkali in the soil, which are responsible for most of the barren lands in the country, were also artificially produced. The famous black cotton soil of Central India was also among the collection.

Then in one corner of the building were found jellies, jams, marmalades, pickles, tomato sauce, chutneys, etc., all of them having been manufactured in the Institute Fruit Products laboratory. While in another corner there were seen in display butter, cheese, ghee, Indian sweets of various kinds, and ice cream which was sold every afternoon to the visitors coming to the Fair.

Pumps, oil engines, feed grinders, chaff cutters and the new Wah-Wah plough which was developed by the Engineering department of the Institute were all on display. The bore-hole latrines

with the borer and the septic tank latrines were also displayed by the Engineering department. The student Social Service League had a large model of a model village on display with members of the league in constant attendance to explain its various features to visitors.

The exhibition was open to visitors mornings and afternoons. In the evenings, after the afternoon demonstrations were finished, talks of special interest to farmers were arranged, followed by moving pictures showing scenes of farm life in America as well as in India. And these were followed every night by dramas depicting the value of hygiene and temperance and the curse of untouchability.

Another special item of interest was the ploughing contest in which about 20 farmers of the vicinity took part, the winners of which received Wah-wah ploughs as prizes.

The last meeting of the Fair which was presided over by Pandit Iqbal Narain Gurtu, the Vice-Chancellor of the Allahabad University, was held in the evening of the 11th March. The speaker of the evening was Pandit Prakash Narain Sapru, who also stressed among other things the value of co-operative credit agencies, co-operative marketing, which he hoped could be established in villages by the extension of the village panchayat system. He also condemned the evils of early marriage and appealed to the villagers to make the school the centre of village life.

Following the lecture, prizes were awarded by Mrs. S. Higginbottom, the wife of the Principal of the Allahabad Agricultural Institute, to the winners of the various competitions in the ladies handicraft and cottage industries exhibits.

It has been suggested that for next year the *Alumni* of the College be organized so as to meet in the College during the meeting of the Fair, which will be an additional feature of next years' programme.

B. M. P.

A bulletin No. 977 from Georgia Experiment Station gives data on vitamin A in Pimiento peppers. This vitamin is credited with being anti-infection in its effect. This is perhaps the scientific explanation of pepper tea for colds.

From partial reports from the municipalities, the Director of Agriculture estimates that not less than 60,00,000 maunds of fruit enter the municipalities of the United Provinces annually. This yields an income to the municipalities of perhaps Rs. 40,00,000.

THE WONDERS OF INSECT LIFE

(Continued.)

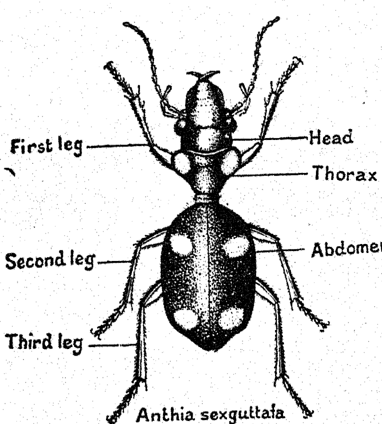
By W. K. Wesley, M. Sc., L. T.

(Entomologist.)

Insects in General.

An insect can easily be recognized from its closely related forms (arthropods) in the possession of a body divided into a series of rings (Segments) placed one behind the other and the grouping of these segments into three more or less well defined longitudinally arranged regions the Head, the Thorax and the Abdomen See Fig.

Head:—The head is the first of these three regions aud it carries the Eyes simple (Ocelli, sing. Ocellus) or compound (Composed of many simple eyes or ommatidia; ing, ommetidium) or both; a pair of feelers (Antennae, sing. antenna) and mouth-parts. The mouth-parts (Trophi) consists normally (Typically) of an Upper lip (Labrum) a Lower lip (Labium), a pair of Upper Jaws (Mandibles) and a pair of Lower Jaws (Maxillae). The structure of the mouth- parts varies very widely depending upon the feeding habits of the insect and the other uses for which they are utilized. The structure of the mouth-parts, therefore, is a valuable clue to the method of feeding and frequently to the nature of food of an insect while effecting proper pest control. Roughly speaking they may be Masticatory as in grasshoppers or Suctorial (Haustellate) as in the butterflies or may be adapted to piercing or cutting the skin as in most bugs or sucking blood as in mosquito.



Anthia sexguttata
(A beetle)

Thorax:—The thorax is the region between the head and the abdomen and is made up of three segments; the first the Prothorax, the second the Meso, and the third the Meta-thorax. Each segment is marked into two main portions the Upper (dorsal) part of the roof (Tergum or Notum) and the lower (Ventral) part or floor (Sterum). The sides known as Pleura (sing. pleuron) carry a pair of legs, each, so that there are three parts or carrying six legs in all (Hexapoda). Each leg is made up of five joints, starting from the place of attachment (basal or proximal joint) they are Coxa, Trochanter, Femur, Tibia and Tarsus.

In the adult stage the meso and meta-thorax carry a pair of wings each making two pairs in all. This, however, is not true of all members of the class for in flies (Diptera) there is but one pair of well developed wings, the second or hind pair being rudimentary, in some bugs (Hemiptera) there are merely vestiges of only one pair of wings, while in fleas (Siphonaptera) and lice (Anopleura) the wings are entirely wanting.

Abdomen:—The hinder most part of an insect or the abdomen consist of a varying number of segment. Normally there are only ten, though eleven occur in various adult grasshoppers (Orthoptera) etc. The terminal segments are modified to form the [illegible]sory organs of generation. As in the case of thorax each segment of the abdomen is composed of a tergum and a sternum connected by a soft pleural membrane. This pleural membrane contains the openings (Spiracles) of the much branched breathing tubes (Tracheae). These spiracles serve the purpose of nostrils in the insects.

Skeleton:—There is no bony skeleton (Osseous system) in the insect body. The protection and support to the various soft parts is given by mean of a hard chitinous ($C_{30}\,H_{50}\,O_{10}\,N_4$) substance forming the outer (Exo—) and the inner (Endo—) skeleton and serves not only as a protecting covering to the soft parts but as an attachment for muscles as well as to maintain rigidity. It is similar in composition to the cartilagenous portion of the skeleton in the back-boned (vertebrate) animals. The exo-skeleton is furnished with hard chitinous outgrowths (setae, hairs and bristles) and at times with spines and perhaps with spurs.

Metamorphosis.

Every animal undergoes changes (metamorphosis) in its life time. These changes may be gradual (Gradual metamorphosis) or may take place within the egg or the parent body so as to escape our attention or may be sudden (complete metamorphosis) and quite apparent. Depending upon the species an insect also in its life cycle may undergo a gradual or a complete metamorphosis. The gradual metamorphosis requires only three stages viz. eggs, young (larva) and adult (imago), while the complete metamorphosis requires four stages viz. egg, larva, resting stage (pupa) and imago to complete the life of an insect.

Growth takes place in the larval stage, the larva shedding (ecdysis) its old skin (exuviae). As it increases in size, a new one having formed takes the place of the old. The larva is active and voracious and this is the stage that is most injurious to our crops etc. When fully grown the larva enters upon a more or less resting stage (pupa formation) in which stage the insect ceases

to eat and is usually quiscent (chrysalis) but may be active as in the case of mosquito larva.

It is in the pupal stage that the most wonderful changes are going on (histolysis and reorganization or histogenesis of the tissues) which transform the lowly worm-like larva (caterpillar) into the fully developed, highly organized adult insect (butterfly). This is an example of a complete metamorphosis. The gradual metamorphosis is somewhat different. The young emerge from the egg not very much unlike the adult except in size, colour and hardness (stiffness). These nymphal stages eat the same food as their parents. The immature forms grow by successive casting off of the skin (Moulting or Ecdysis) similar to the larval stages of the complete metamorphosis. There is no differentiation of sexes until the final moult which results in a completely formed and fully grown insect. These immature monlting forms correspond to the larval and pupal stages of the complete metamorphosis.

Digestive System

The food canal consists of a long, more or less straight tube, modified at various places according to the nature of the food taken in. The salivary glands open into the mouth cavity (Buccal cavity) through the salivary duct (Salivos) and the saliva acts on the food.

Circulatory System

There is no vascular system in insects. The blood which is colourless circulates in body cavity (Hæmocoel). It is kept in circulation by passing through thin walled pulsating Aorta located in the extreme dorsal part of he abdomen and thorax.

Respiratory System

There are no lungs or gills (except aquatic insects). Air is taken in through stigmatic openings (Spiracles) located on the sides of the thorax and abdomen. It is carried to the most remote parts of the body by a system of branching tubes (Tracheae) which have their origin at the spiracle.

Nervous System

The central nervous system consists of a chain of ganglia running close to the ventral wall, beneath the alimentary canal from the head through the thorax and into the abdomen. The first or the largest ganlin the brain, is located in the head and is pierced by the oesophagus.

The special sense organs are also well developed.

Excretory System

The kidneys are represented by the Malpighian tubules which open into the intestine.

ELEPHANT OR NAPIER GRASS

(PENNISETUM PURPUREUM)

by B. M. Pugh, B. Sc., (Ag.) Calif.

This plant belongs to the great family of grasses which includes some of the most important crops of the world, like wheat rice, barley, etc. It is, however, more closely related to *bajra* (Pennisetum typhoideum) which is one of the important millets and fodder plants of India. Unlike *bajra*, however, which is a native of India, Napier grass is a native of South Central Africa and has only of recent years been introduced into India where it is gaining its popularity very rapidly, as a fodder crop as it remains green throughout the year when many other grasses fail; and because of its very high yield and also because it is relished by cattle.

This grass is a perennial and once planted it lasts for several years. It possesses short creeping root-stocks and therefore in a few years it forms a dense tuft of about three to four feet in diameter. Its stems are thicker than most grasses being about three-fourths of an inch in diameter or about two inches and a half in circumference. It stands almost erect, being slightly decumbent at the base and reaches a height of five to eight feet. The leaves are two and a half to three feet long possessing a tightly clasping sheath about three-fourths feet in length and over-lapping one another. The leaf-blades are about one and three-quarter inches wide. The inflorescence is a spike, about $\frac{3}{4}$ feet in length and closely resembling that of *bajra*.

Napier grass has also a fairly deep root-system which enables it to stand dryness to a considerable degree.

Under the conditions prevailing in most parts of India, Napier grass would appear to be the best fodder grass. As a green fodder it contains all the food requirements in desirable proportions.

In the most desirable elements, proteids and ash, Napier grass seems to be superior to our standard forage plants *jowar* and maize. In our feeding trials at the Allahabad Agricultural Institute it has also been found that Napier grass in liked more by cattle than Guinea grass (Panicum maximum), another very popular fodder plant. As between jowar and Napier grass however, the palatibility seem to be the same, perhaps because jowar contains some sugar in it. Napier grass is also relished by all the other animals on the farm, including goats, pigs and chickens.

Type of Soils: The plant will grow in almost any type of soil; but it will do best in a loamy type of soil which should be

well-drained. It does not do well in soils that crack during the summer, or soils that are too retentive of moisture.

Planting, Cultivation etc: The grass should be planted in a fairly level land. The soil is ploughed two or three times and then harrowed with either a spike tooth or spring-tooth harrow, so that the weeds are collected and thrown away. And either a roller or planker or a *patela* may then be drawn over the field so as to make the surface smooth and also to compact the soil a little. The furrows are then made about three and a half feet apart with a furrow maker. If the soil is too dry water may be run into these furrows.

Napier grass is propagated not by seed but by pieces of root-stalks or tussocks, or by cuttings or by rooted slips. The last probably gives the best results. The rooted slips are planted singly in rows at a distance of about three feet apart between the plants. If cuttings are used, they should be taken from mature plants, each being 1½ to 2 feet long, planted slantwise with two-thirds below the ground. The soil is then firmly packed around the root of the plant.

The plants are then irrigated whenever necessary at intervals of about a week at the beginning if there has been no rains in the meantime. The soil is also cultivated and the weeds are removed at regular intervals.

Napier grass is drought resistant; it can withstand dryness better than most fodder crops. But for getting a profitable crop the grass cannot be grown without irrigation.

Napier grass is also highly resistant to frost and is therefore able to stand coldness better than *jowar* and Guinea grass..

A plantation once started lasts for several years. And in the course of three to four years, alternate tufts of Napier Grass may be removed for planting elsewhere, or even alternate rows of plants may be removed without materially decreasing the yield. As several cuttings are taken annually from the plant it is desirable to manure the field heavily as much plant food is lost to the soil.

Cuttings: Napier grass is cut as close to the ground as possible. The first cutting may be obtained in three months after planting if the planting is done at the beginning of the rains, and each successive cutting after every month. In all about ten cuttings are obtained every year, with a total yield of about 3,000 maunds of green fodder per acre. If the land is manured with farm manure, or if the field is irrigated with sewage water this yield may be kept up for several years.

Not only is Napier grass a very good green fodder, but it also makes good silage.

THE SANGLI MOVABLE SCHOOL

A Travelling School in Western India.

By J. L. Goheen.

Dr. Booker T. Washington that great soul of wide vision and deep insight into the problems of practical and constructive education for the Negroes of the U.S.A., not only built up a large and most useful educational institution, the Tuskegee Industrial and Agricultural Institute, but also took it upon himself to deliver education to those in distant hamlets and villages who were not able to come to Tuskegee for it.

Quoting from the July, 1927, number of "Better Crops with Plant Food", on the subject: "Wheeled Schools Deliver Education", it is stated, "the Negro farmer as a rule is diffident about attending the regular agricultural instruction given at central points in the various communities. And the more ignorant he is the more difficult it is to get him out. To Booker T. Washington and his faith in the principle of learning by doing, the new scheme of things owes its beginning and its promise of great achievement. He knew the Negro farmer well enough to know that there was no hope for advancement unless modern training could be carried to his doorstep."

And so, "in 1906 Washington built the 'Jesup Agricultural Wagon'. "It was fitted with farm implements, dairy apparatus, garden tools, and crates containing specimens of improved types of crops and livestock......With the wagon went an agricultucal extension demonstrator. Nothing more ambitious than the county surrounding the Tuskegee Institute was attempted. But it was a success, so much so that later when automobiles came in, a truck known as the Knapp Agricultural Truck was substituted".

"This truck has carried better farming and home-making into every county in the State where there are Negro extension agents and is still in use. But the scheme was to be pushed further. In 1923, by contributions from some 30,000 Negro farmers and their friends, a large truck especially designed for the work was built. It is known as 'The Booker T. Washington Agricultural School on Wheels'. This truck carries a complete stock of farm implements and home conveniences such as the average farmer would be able to buy or construct and operate. With it goes a man to demonstrate the use of the equipment and to teach improved methods of farming; a woman to show how to make and use the home conveniences, and to cook, can (preserve), care for poultry, and conduct the home on a more healthful and economic basis; and a rural nurse who gives demonstrations in care of the sick and simple practices of home sanitation and hygiene"..........

Having seen the Booker T. Washington, Agricultural School on Wheels actually at work in a small hamlet and having noted the enthusiasm with which its many-sided programme was received and made use of by the men, women and children of that neighbourhood, the writer was inspired to try to secure a similar 'travelling school' for the institution in India with which he is connected, the Sangli Industrial and Agricultural School. Any one who has taken the trouble to investigate will agree that there are a good many problems in common for the uplift of the backward Negro and the illiterate villagers of India. The latter are hard to reach and it is just as necessary to 'deliver education' to them as it is to deliver it to the Negro. More especially is this true of the women of the village.

The Sangli Movable School came into being in the early part of the year 1931. It is not an exact duplicate of the Booker T. Washington Agricultural School on Wheels, but the main idea is there. It has been fitted up so as to be of special use in the way of practical teaching and demonstration to the people of village India. Through the use of numerous charts, posters and pictures on all kinds of subjects pertaining to village life; also small and improved livestock such as fowls and good milk goats; simple and 'better' implements such as fodder cutter, light iron plough and cultivator for the lighter soils (unfortunately the heavier implements cannot be carried); samples of seeds of improved and tested varieties of field and garden crops and specimens of potatoes and sweet potatoes, ground-nuts, wool and cotton, etc.; this school aims to put on an exhibition such as will be of use to each village visited.

It also carries an earth-auger for the making of bore-hole latrines; tools for digging model manure pits; a trunk full of books on agricultural and similar subjects in Marathi and English which serves as a Reference Library, and there are similar simple and useful books on many subjects for sale. There is a medicine chest with the much-needed yet simple remedies, a gramaphone to furnish music and amusement, and a Magic lantern and cinema projector with small special electric generating unit, not to mention electric light bulbs which illuminate the scene at night like fairy-land. What crowds always attend and what an opportunity to teach through eye-gate and ear-gate at the close of the day, when the people, big and little, are free to sit and learn!

The displays are set up in sections, as it were. Here is a section dealing with Sanitation and Preventive Medicine; another section has to do with Agriculture and Field, Fruit and Garden Crops, a third has to do with Child Welfare; and a fourth with Cottage Industries such as Bee Keeping, Soap Making, etc., etc. The Poultry and Livestock sections are always popular. There

are generally three members of the crew, viz., the Manager and general Utility man, and he is a very capable and talented individual; an agriculturist who knows that end but also makes himself generally useful; and a helper who has no end of things to see to. These three are kept busy from early morning until after midnight, and it is truly a 'strenuous life they live. There are special days or times for the women and school children, and if Boy Scouts are to be found in a village, you may be sure they are put to good use in a clean-up campaign' or something of that sort.

The School will stop from 3 to 10 days in any given place, this depending on the size of the place and interest shown, etc. An average stop would be about 5 days. On one night of this period it is usually the practice to put on a drama, say the last night of the visit, school boys and masters having been co-opted to make this possible. The booklet, "Little Plays", by Emily Gilchriest Hatch, is most useful for this purpose. It is always the aim to leave something permanent in the village as a result of this visit, say some model manure pits or bore-hole latrines, or the organization of a poultry club, or a few seeds of some improved crops, or the organization of a village reading room, etc. If ever again the School visits that locality, follow-up work must be carried on of course, and this is often also done through the contacts made.

During the monsoon season the School is used at head-quarters for bazaar demonstrations etc., and then too, a general over-hauling of everything connected with it is always required. During the rest of the year it is on 'the move' most of the time. It visits a good many agricultural exhibitions, helps with baby and health week celebrations, and is much in demand for such affairs. However, it is at its best in a central village far off the beaten path, where the general populace is so handicapped by ignorance, poverty, disease and debt. In such a place the Sangli Movable School delights to give its message of Hope, Good Cheer, Light and Love.

"I believe thoroughly in agricultural education. I regard it as one of the most important and essential branches of the whole educational effort that is being carried on in the United States".

FRANKLING D. ROOSEVELT,

West Virginia Farm News.

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE FARM

February 1934

Date	Max. Temp.	Min. Temp.	Mean Temp.	Percentage Humidity.	Atmospheric Pressure.	Rain for the Day.	Rain since Jan. 1.	Direction of the wind.	Remarks
1	71	40	55·5	70	29·86	..	·90	W	Beginning of harvest of mustard and gram on un-irrigated land. The harvesting of potatoes continues. Irrigation of potates and other vegtables
2	71	40	55·5	55	29·88	..	„	W	
3	66	39	52·5	50	29·88	..	„	W	
4	69	43	56 0	55	29·86	..	„	W. S. W.	
5	71	41	56·0	50	29·86	..	„	W	
6	71	42	56·5	45	29 88	..	„	W	
7	72	40	56·0	60	29·84	..	„	W. S. W.	
8	74	42	58·0	50	29·84	..	„	W. S. W.	
9	76	43	59·0	48	29·78	..	„	W. S. W.	„
10	79	45	62·0	55	29·72	..	„	S	„
11	81	46	63·5	60	29·68	..	„	W	„
12	79	53	66·0	65	29 60	..	„	Calm	„
13	79	56	67·5	75%	29 62	..	„	N. N. E,	„
14	80	58	69·0	73	29·64	..	„	Calm	„
15	81	55	68·0	72	29·62	..	„	W. N. W.	„
16	83	58	70·5	70	29·56	..	„	E. S. E.	„
17	85	58	71·5	70	29·50	..	„	E. S. E.	„
18	85	53	69·0	68	29·68	..	„	W. S. W.	„
19	85	52	68·5	72	29 66	..	„	W	„
20	83	54	68·5	70	29·67	..	„	E. N. E	„
21	87	56	71·5	74	29·63	..	„	N. E.	„
22	85	57	71·0	70	29·52	..	„	E	„
23	87	59	73 0	70	29·44	..	„	W. S. W.	„
24	87	60	73·0	65	29·44	..	„	S. W.	„
25	89	59	74·0	72	29·54	..	„	E, N. E.	„
26	86	59	72·5	74	29·48	..	„	Calm	„
27	91	64	77·5	30	29·46	..	„	W	„
28	90	55	72·5	30	29·46	..	„	S. S. W.	„

March 1934.

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage Humidity.	Atmospheric Pressure.	Rain for the Day.	Rain since Jan. 1.	Wind Direction.	Remarks.
1	82	49	65·5	50	29 64	..	·90	S. W.	Winter ploughing continues. Barley gram Linseed, mustard are being harvested.
2	86	54	70·0	58	29·70	..	,,	Calm	
3	90	51	70·5	30	29 70	..	,,	S. W.	
4	89	51	70·0	35	29·70	..	,,	N. E.	
5	88	60	74·0	37	29·72	..	,,	E. N. E.	,,
6	84	64	74·0	80	29 82	·12	1·02	S. S. W.	,,
7	71	57	64·0	78	29 76	·20	1·22	N.	,,
8	80	56	68·0	75	29·76	·49	1·71	E. N. E.	,,
9	80	62	71·0	69	29·64	·03	1·74	E.	,,
10	84	59	71·5	65	29 58	..	,,	S.	Threshing of gram begins and also of barley.
11	86	60	73·0	65	29·54	..	,,	E. N. E.	
12	90	60	75·0	63	29	..	,,	W. N. W.	Harvesting of wheat begins.
13	82	57	69 5	49	20 57	..	,,	W.	Harvesting of wheat continues.
14	81	52	66·5	30	29·68	..	,,	S. S. W.	Last day for harvesting of mustard.
15	83	55	69·0	33	29·76	..	,,	W. N. W.	
16	84	55	69·5	31	29 71	..	,,	W	
17	85	53	69·0	30	29 68	..	,,	W	,,
18	87	52	69·5	32	29 64	..	,,	W	
19	90	54	72·0	28	29 70	..	,,	W. S. W.	First day of digging hill potatoes.
20	94	51	74·0	33	29·66	..	,,	W	Last day of digging early potatoes.
21	96	66	81·0	36	29 66	..	,,	W	
22	96	70	83·0	35	29·54	..	,,	S. W.	Threshing of wheat begins.
23	96	71	83·5	37	29 58	Trace	,,	S. E.	Leaves collected for litter.
24	96	70	83·0	40	29 58	,,	,,	S	
25	94	65	79·8	35	29·54	..	,,	W	
26	98	66	82·0	24	29·50	..	,,	S. W.	
27	99	62	80·5	28	29·48	..	,,	E	
28	100	64	82·0	25	29·54	..	,,	W	
29	98	64	81·0	15	29·57	..	,,	W	
30	102	70	86·0	17	29·50	..	,,	W	
31	104	70	87·0	15	29 44	..	,,	W	

HOW TO THINK STRAIGHT.

It is a Rare Habit, Says a Columbia Psychologist, Who Gives a Test For Thinking and Rules to Keep it Straight.

By Morjorie Van De Water.

Do you think scientifically?

Most people do not, says Dr. Victor H. Noll, of Teachers' College, which is part of Columbia University.

If people did think scientifically, the depression could never have occurred, and many of our social ills could not exist.

"Individuals who are in the habit of thinking 'straight' do not invest in enterprises of which they know little or nothing," Dr. Noll declares. They do not mortgage their homes in order to buy expensive luxuries or get rich overnight. Nor do they look down on their friends and acquaintances who refuse to do these things.

"We still spend millions of dollars annually on worthless or positively harmful nostrums—beauty aids and quack remedies. We buy almanacs that predict the weather for a year in advance. We judge a man by his facial characteristics; we vote for or against him because of his clothes, or his religion, or his wife's personality. We still have mediums, soothsayers, phrenologists, palmists, mind readers, and astrologers patronized and supported by persons in all walks of life."

Do you think scientifically?

Fundamental Habits.

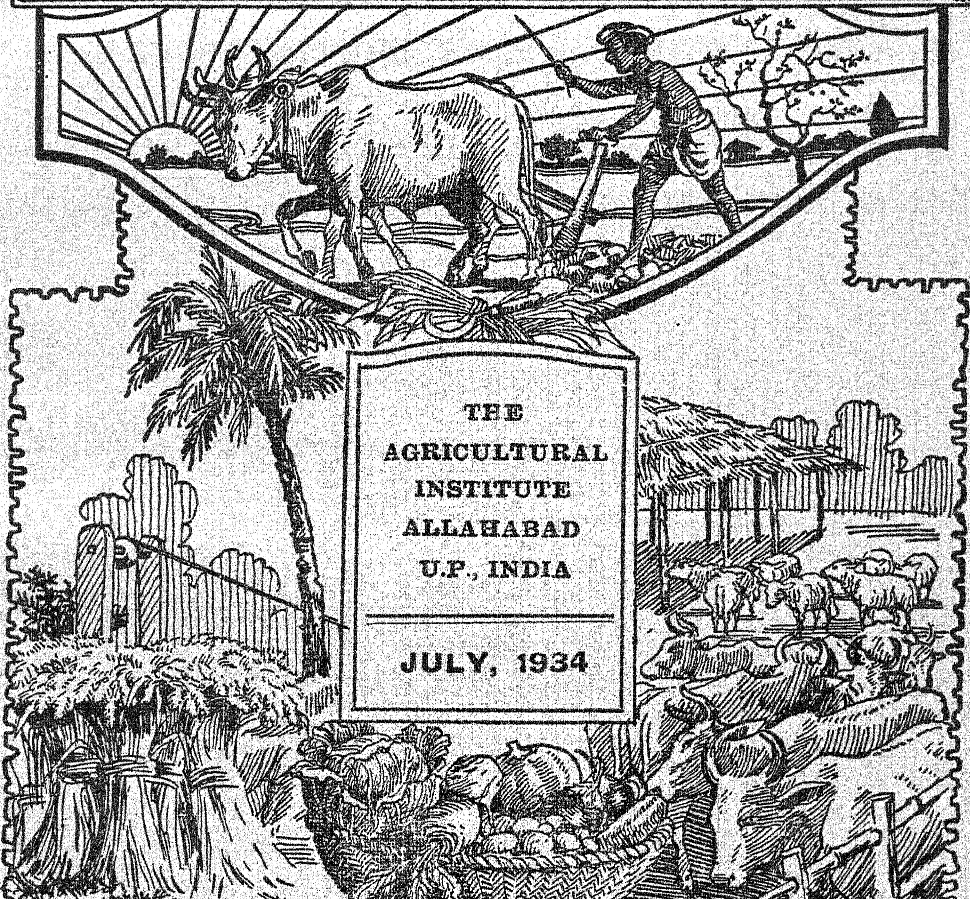
In order to develop a scientific attitude, you must develop six fundamental habits of thinking, Dr. Noll says. Look the list over and see how many of these habits you have developed in yourself.

1. Habit of accuracy.
2. Habit of intellectual honesty.
3. Habit of open-mindedness.
4. Habit of suspended judgment.
5. Habit of looking for true cause and effect relationships.
6. Habit of criticism, including self-criticism.

VOL. VIII] [No. 4

THE ALLAHABAD FARMER

A bimonthly Journal
OF
Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE
ALLAHABAD
U.P., INDIA

JULY, 1934

"If rural India is to realize her destiny, rural girls and women must be educated. Women's education viewed from the standpoint of national growth is more important than men's. When you educate a boy, you educate one. When you educate a girl you educate a family, and enrich a home."

SAM HIGGINBOTTOM.

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The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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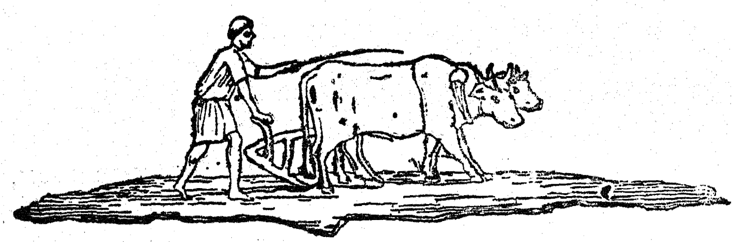

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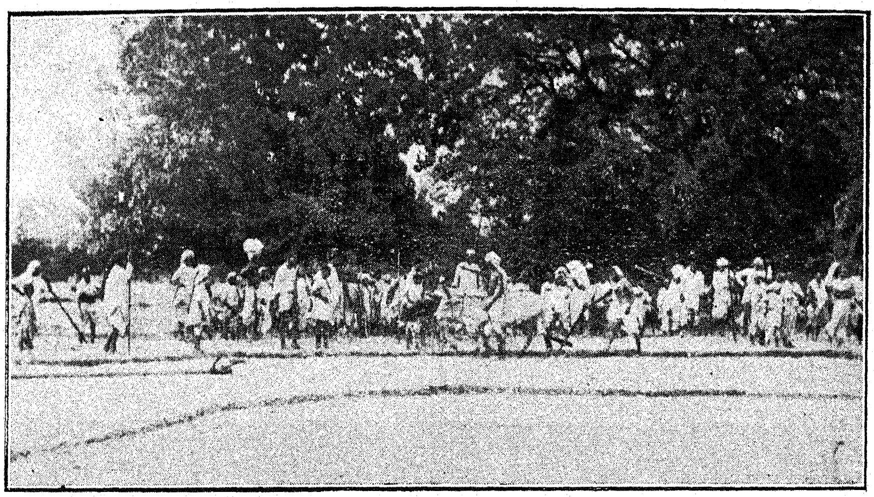
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION - SERAI AQIL

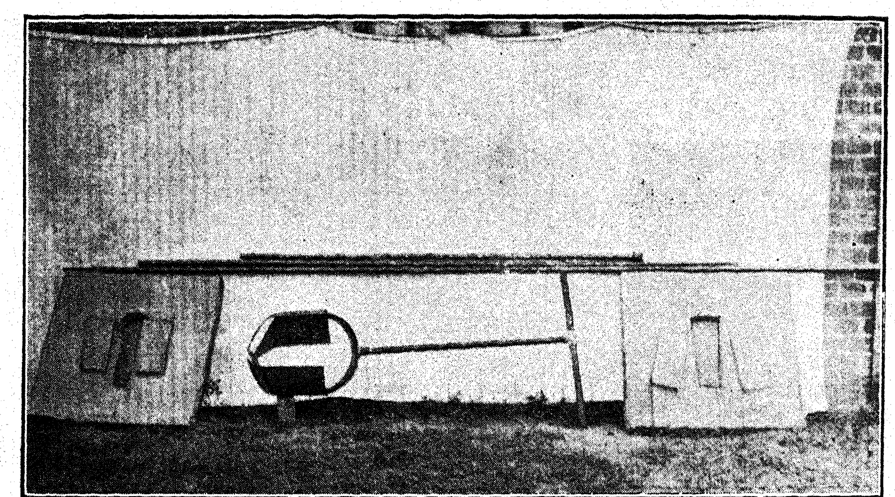
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE

ALLAHABAD FARMER

VOL. VIII] JULY, 1934 [No. 4

Editorial

The Fruit Industry in the United Provinces

During recent months we have read more news in the daily papers about fruit-growing than we have in the last so many years. It seems that the fruit industry in the province is receiving a great impetus during the last few months. Much of this new interest in fruit-growing is due, no doubt, to the enthusiasm of Mr. R.G. Allan, the present Director of Agriculture of these provinces. We have no doubt at all but that there is much room for the development of this industry not only in these provinces, but in the whole of India. What justification there is for the import of tinned pine-apples from Hawaii when there are places in India where better pine apples can be grown than those we get from Hawaii? Or what justification is there for the import of Del Monte fruit products from California or of Bartlett pears from Australia or of fresh, nice-looking but insipid apples from Japan, when Kashmir and some of our hill stations can produce these fruits which are in no way inferior to those we get from other countries? But hasn't India also some of the best mangoes, the best guavas ever produced? But are the Indian cultivators as a rule growing the best varieties of these fruits? Isn't almost the rule, on the other hand, to grow the poorest varieties of mangoes throughout our villages? It is time therefore that the country wakes up to the fact, and that our Agricultural departments take in their hands the task of telling the villagers not only the best but the most suitable varieties of fruits for any particular locality. We feel therefore that the efforts of our Director of Agriculture to start Fruit Growers' Associations in the province, to hold fruit exhibitions in important centres and the formation of the Fruit Development Board are all along the right lines. We might also suggest that a fruit specialist be appointed in the Department of Agriculture in these provinces along the same lines as in the Punjab Department of Agriculture where we know the fruit industry got greater impetus than in any other province of India.

Of course we also believe that the industry will be greatly expanded by the expansion of the market for fruits, namely through better shipping facilities and storage, through a more uniform method of grading, and through the development of the canning (or tinning) industry.

We would urge therefore (1) that Governments investigate the possibilities of better storage during transportation, (2) that the country define the standards or grades of different fruits, so that a consumer may know what to expect if he orders fruits from a distant place, and (3) that a fruit products laboratory be set up in connection with one or two of the existing agricultural colleges in the province with a view to investigate the possibilities of developing the fruit canning industry in the country.

* * * *

The Ice Cream Menace.

The eating of ice cream during the hot weather has become a fashion in most parts of India. Ice cream is now being made available not only in big cities like Calcutta and Bombay, but in larger towns, like Allahabad and Lucknow, the eating of ice cream has become a rage with the student community.

An incident which took place the other day in one of the leading hotels in Lahore and which was reported in the "Tribune" of May 6th, would however serve as a reminder that the eating of ice cream is not so safe after all. It was reported that several prominent doctors of Lahore, including the principal of the Medical College were victims of food-poisoning which was due to the eating of ice cream.

The major constituent of ice cream is milk and milk as it used to be consumed in this country is always boiled. It is not consumed without boiling as is done in America and other countries. That is the only safe way of drinking milk in India, namely after boiling, as long as we get our milk through "gowalas" who have very little idea of sanitation, as long as milk is not available from sanitary dairies; for in the process of boiling, practically all of the pathogenic bacteria which develop so rapidly in milk, are destroyed.

Ice cream, however, which is generally sold to the public, is made from milk that has not been boiled. The milk that is generally used for making these ice creams in from "gowalas" who carry it in open utensils which bacteria flying about with the dust get in. When milk is "freezed" the bacteria are not killed but their growth is checked. Hence ice cream made from milk containing these bacteria is harmful.

Milk is known to be a very good medium for the development of bacteria which cause typhoid, dysentery and many other diseases. Hence a person eating ice cream made from such milk is making himself liable to an attack of those diseases.

An American doctor who had practiced for about 24 years in Canton, China, says that typhoid cases in China have increased considerably within the last few years. And he believes that this increase is somewhat connected with the introduction of ice cream to China. For while a Chinaman drinks nothing but tea, none of these typhoid bacteria can do him any damage, but when he takes to eating ice cream he makes himself susceptible to all kinds of diseases, including typhoid.

We would urge the public of India therefore first of all to encourage sanitation in the production of milk, to insist on having "gowalas" get medical certi cates to show that they are free from typhoid or dysentery, that ice cream factories or dairies be open to official inspection and that no ice cream made in alleys nor near sewers be allowed to be sold to the public.

* * * *

The Agriculturist Relief Bill.

We have no doubt at all, that in this period of economic depression, the agriculturists are the worst sufferer . So although we have not had occasion to study carefully the bill referred to and also the plan formulated by the Government of these provinces through which rents and land revenues would fluctuate according to price levels, yet we feel sure that they are both laudable and to the good of the farmer.

We also welcome the appointment of a commission by the King-Emperor, which will make a survey of the economic conditions of the people of India.

In this connection we may point out that the Punjab has given a lead in this matter. A detailed economic survey of many parts of the province is already being made under the supervision of the Board of Economic Inquiry (Punjab). It is only such surveys, we believe, which will reveal the magnitude of the sufferings of our farming communities.

* * * *

Goat-Keeping in India.

In this issue we present the first of a series of articles on "Keeping Milk Goats in India". They are really reprints from a booklet of the above title by Mr. J.L. Goheen of the American Presbyterian Mission, Sangli. We believe that these articles are timely and we would recommend the book to all those who are interested in goat-keeping

or goat-farming in India. The book is available from Mr. Goheen, A. P. Mission, Sangli, Bombay Presidency at 8 annas per copy.

B. Sc., Agriculture Results, 1934.

The following are the results of the B. Sc. Ag. examination of the Allahabad University:—

Second Division.—(1) A. K. Mallik, (2) A. M. Sinha, (3) P. N. Prasad and (4) S. C. Chowdhury.

Third Division.—(1) Bimol Kumar Bose, (2) G. P. Jakhanwal, (3) K. C. Sarveriya, (4) Md. Badruddin, (5) M. P. Singh, (6) M. J. Zachariah, (7) M. L. Tarlekar, (8) N. N. Chaturvedi, (9) Suraj Sinha, and (10) Sheo Shankar Lal.

The Agricultural Institute is to be congratulated on these very satisfactory results attained by the students, as out of 14 students sent up for the examination, all passed, and this is the first batch of students sent up for the degree examination.

We have also learnt with satisfaction that some of these students have already been employed, some as estate managers and others as instructors in agriculural institutions.

*   *   *   *

Rats

Porcupines and several of their kin have at one time or another been a source of a lot of trouble to the farmer. About a year ago, the occurrence of rats in large numbers in certain wheat fields of the farmers in the district of Allahabad made the production of that crop almost undesirable. Rats, as was mentioned in our last issue are also a source of plague infection. Yet the Indian cultivators' apathy towards killing them has made them increase enormously wherever they have occurred. It is, therefore, gratifying to note that certain departments of Agriculture in India have taken upon themselves the task of destroying them. For years the authorities of the Allahabad Agricultural Institute have been fighting a ruthless war with this pest; and they have found that it pays the farmer to carry a pump with finely ground potassium or calcium cyanide which is pumped into rat-holes. This cyanide coming into contact with moist soils is converted into hydrocyanic gas, a very strong poison which causes instantaneous death to all rats that breathe the air. One man, carrying the pump during certain periods of the year has been able to almost exterminate this plague carrier from the farm of the Allahabad Agricultural Institute, an area of over 500 acres. We recommend this method to all those farmers who are troubled with this pest.

THE ALLAHABAD CHRISTIAN COLLEGE

Dr. Sam Higginbottom

Educational work in Allahabad for boys and young men was begun by the American Presbyterian missionaries in 1842. In 1848 the East India Company turned over their more advanced educational work to the Mission. This gave an institution with over a thousand pupils. It grew rapidly until the disturbances of 1857-58 dislocated all plans. As soon as things quieted down the school reopened as a high school. The post-school classes were not resumed until 1901 when the Allahabad Christian College opened classes under the dynamic and enthusiastic leadership of Dr. Arthur Ewing, one of the greatest personalities and keenest educationists these provinces ever knew. He was a man of vision, he had faith in India. He believed India would need and make use of technical education as well as arts and science. He started a department of electrical and mechanical engineering and approved of the work in agriculture. He gathered about him a brilliant staff, Professor Prabhu Das in Chemistry, Dr. Edwards in Physics, Professor N. C. Mukerji in Logic and Philosophy, Professor Weld in Economics, Professor Mitra in Mathematics, Dr. Dudgeon in Botany, Professor Thompson in Economics. His early and lamented death was a great loss. But the College grew in numbers and departments, adding post-graduate work, and made a name for itself through the splendid young men it turned out. Its future seemed assured.

Them came the educational cyclone. This caught the two American missionary colleges of the United Provinces in its path, and, not because they were not doing good work, but just because of the accident of location, they were decapitated and the educational forces of the provinces were deprived of an important factor in their ordered progress. There are complaints in some quarters that there is too much higher education in India. This is not so. There is not nearly enough of the right sort of higher education. The only education that is doing any harm to India to-day, is the education India needs but does not secure. Education is not nearly so costly to India as is ignorance and illiteracy.

Firmly holding this belief, the four Institutions for men and boys under the American Presbyterian Mission in Allahabad considered how they might better serve India. Fortunately, about this time, the Lindsay Commission came along with its careful analysis and criticisms. It suggested lines of efforts in the preparation of teachers, and in research, and especially for one of the units, in the problems of rural life. The result of the consquent deliberations was a resolve to unite.

We are rejoicing in the fact that the union of the four constituent units into the Allahabad Christian College has been approved by the New York Board for a trial period of three years.

Several have asked what is gained by this union. As I see it, the value lies, first, in the strengthening of the morale of both student body and teaching force. We now have a ladder from the primary school to the graduate school of the university, with a unified programme under a single management. This provides an outlet for the best in both groups. It offers a wider choice to students than almost any other institution in the province. There is a sense of team work which produces a sense of power. Ther is stimulation to the staff for research work.

Secondly, while the total cost of the unified Christian College is going to be greater than the total cost of the four individual units, yet measured in terms of output, the union is a measure of both economy and efficiency. The student looking forward to his lifework has a wider selection, the teacher has in his classes those who are eager to receive his particular contributions. If he is a specialist he will not spend so much time in unrelated work, he can be more fully occupied with that for which he is best qualified.

Thirdly, we can so arrange our programme that all our class-room, and laboratory facilities are fully occupied every working day. As separate units, there was a measure· duplication of staff and laboratory apparatus which was not fully engaged all the time.

Then fourthly, in administration there is centralization and reduction in cost of overhead per student, one treasurer instead of four, one purchasing agent, etc.

As a result of the union there is to be a strengthening of each department. Holland Hall as University centre has a great record, but the University claims, and with justice, that we have not done all we could have done there. In accord with the Lindsay Report it is hoped to persuade some distinguished scholars, both Indian and foreign, to make this a research centre in connexion with various phases of University life. One field calling for investigation is the problem of employment for educated men; another rural reconstruction. Then there are not enough trained teachers in the province, nor are there sufficient training schools to keep up the supply of trained teachers in existing schools, to say nothing of the inevitable and highly desirable increase in both the number of schools and the number of pupils in the province. So the old Jumna High School with a continuous record of over ninety years' service becomes part of the education department becoming a practice school for teachers. Especially in the field of rural education as

well as in urban education, is there need for finding a more suitable type of education and a better method. Therefore, as far as staff and funds permit, the department of education is being instituted, with the mandate to undertake research into the problems of Indian education.

One feature of this will be the development of co-education, and of training women teachers for rural schools with the idea that these will get nearer the village girls and women than the present men teachers can. If rural India is to realize her destiny, rural girls and women must be educated. Women's education viewed from the standpoint of national growth is more important than men's. When you educate a boy, you educate one. When you educate a girl you educate a family, and enrich a home.

The Agricultural Institute is slowly making progress in helping the poverty-stricken, debt-laden village farmer. It has several lines of useful work as the improvement of Indian breeds of dairy cattle by selection, and the search for a new and better breed through cross-breeding.

The Engineering department has busied itself with bore-hole latrines, to improve the sanitation of the village, an improved plough for village farmers.

The Horiticultural department is investigating the possibilities of the preservation of fruits and vegetables.

The Agronomy department is supplying improved seeds, investigating the control of crop pests, both insect and animal.

The first B. Sc., Agricultural Class takes its final examination in connexion with the Allahabad University. Very happy relations have been established between the Christian College and the Allahabad University. The College is not duplicating anything the University is doing, but is enriching University life by the addition of a subject of superlative importance to India. In return the students are admitted to the degree of one of the best universities of India. It is confidently expected that these cordial and helpful relations with the University will continue and grow. This connexion assures the College of a share in Indian education, it keeps it in touch with national life and movement and aspiration, it makes it a partner in that which is so full of promise, a fuller richer life.

Ewing College will continue its strong departments of science, thus ensuring a supply of well-trained candidates for the Medical school, and for teachers of Science. Its Arts departments while covering the whole syllabus, emphasize English, Economics, Mathematics and History, thus preparing all round men for the public service and the professions.

(Continued on Page 149.*)*

THE 'PHUNGI' OR KHARIF GRASSHOPPER.

By P. B. Richards, I.A.S., Acting Director of Agriculture, U. P.

This insect causes great damage to the sugarcane crop by eating the leaves. It also causes loss in all other kharif grain crops, such as paddy, juar, bajra, maize, etc.

The damage caused by 'Phungi' is very serious, especially in the Eastern Districts of the United Provinces, but the insect sometimes appears in large numbers in other parts of the United Provinces also.

Life and Habits of 'Phungi.'—The eggs are laid at the end of the monsoon rains. The female makes a hole in the ground, three or four inches deep, and lays her eggs in a packet in the lower part of this hole. The eggs remain buried in the soil until the commencement of the next rains. As soon as the ground becomes sufficiently moist, the young grasshoppers are formed inside the eggs, and come up out of the ground and commence to feed. These young grasshoppers are small, and green in colour. They feed upon wild grasses and upon the young green crops, and as they are small and do not eat very much when they are young, the cultivator does not take any notice of them and is not alarmed. As they grow in size, they eat more and more each day, so that soon the damage they do to the crops in fields becomes great, and the leaves of whole fields of sugarcane or grain crops may be so eaten up that only the stems and the mid ribs of the leaves are left. The result of this is that the plant may dry up and die. Even if new leaves are put out, the growth is less and the plants remain small and weak, and give a very poor yield. It is usually at such times, when the damage has already been done, that the attack is reported to the Agricultural or Revenue officers, and help to prevent further loss is asked for. By this time the grasshoppers have become big and active, and can leap a long way and move about very quickly; or they may have grown their wings and be able to fly. Also the crops by this time have grown tall so that it is not possible to catch the grasshoppers. There is no medicine or poison which can be issued to kill these insects, so the damage goes on until they have laid their eggs and died; that is at the commencement of the cold weather.

Control.—There are only two things which can be done to prevent loss by grasshoppers. One is to destroy as many of the eggs as possible, by ploughing to a sufficient depth to turn them all up before the hot weather; and the other is to catch the young grasshoppers by bag-traps while they are feeding on grasses and young crops.

Ploughing Out 'Phungi' Eggs.—This pest breeds only once a year. The eggs are placed in the ground after the monsoon at a depth of three or four inches. All fields which are subject to attack by 'Phungi' should be given a deep ploughing before the hot weather. By this means many of the eggs will be destroyed at once, and a lot more will be dried up by the sun or eaten by birds. Improved ploughs are required for this work. The *desi* plough does not go deep enough or turn the soil over. Early ploughing and a hot weather fallow not only help to keep down the 'Phungi' attack but also make the fields more fertile, and increase the yield of the next crop. If suitable ploughs are not available for deep ploughing, the fields should be dug over with 'phawras'.

As some of the eggs will be laid in the field boundaries (mendhs), these should be kept small and should be ploughed or dug over if possible.

Catching Young "Phungi" in Bag Traps.—While the young "Phungi" are still small and are feeding on grass or on young paddy, juar and bajra plants, they can be caught in bag-traps and destroyed.

A bag-trap can be made of gunny or other suitable loosely woven cloth. It should have a mouth four feet wide, and two feet deep, and should be about four feet from the mouth to the back end.

The end of the bag should not be sewn up but should be closed before using by tying round with a piece of string.

The mouth is held open by a light frame-work of bamboo or other straight sticks, on to which the bag is tied. The bag-trap should be drawn quickly over the surface of the grass or young crops by two men, one on each side, so that the young grasshoppers are caught in the open mouth. The catch is shaken down into the end of the bag and the insects destroyed, either by trampling on the bag or by untying the end and shaking them out into a large pan containing water and a little kerosene oil.

This kind of bag-trap is also very effective for catching the "gandhi" bug when it attacks the rice fields.

Need For Combined Work.—In order to prevent loss by 'Phungi' it is necessary that all the cultivators in the area should plough their fields and catch grasshoppers by the methods described. It would do little good if the grasshoppers of a small area are killed and nothing is done in the remaining fields, as the grasshoppers from these will spread over the whole area. All cultivators should take their share in the work, and the whole area attacked by the grasshoppers should be considered as if it were one field. It is only in this way that damage by 'Phungi' can be stopped and a full crop obtained.

THE DEVELOPMENT OF THE PLOUGH

By Mason Vaugh, B. Sc., A. E.

While the history of early agriculture is lost in the mists of antiquity, it seems probable that the plough is one of the oldest if not the oldest implement in use to-day. There is reason to believe that it is nearly as old as the next older which is probably some form of hoe or spade. Probably man's first implement or tool used for agriculture was a pointed stick sharpened by breaking or by burning the end in the fire and used to loosen the soil so that the seeds of wild plants useful for food could be planted. Harvesting could be accomplished by plucking the ears with the hands and weeding was either similarly accomplished or entirely neglected. To loosen the soil for planting the seed required something besides the fingers.

Loosening the soil with a pointed stick is hard work. The alternatives to pushing it into the soil would be to utilise kinetic energy by striking as with a hoe or pharwa and to scratch the soil by pulling a forked instrument. It seems likely that the first implement substituted for the crude pointed stick was a forked stick with one short prong used for digging and one long prong used to pull the short one through the soil. While we have no authentic evidence, it is easy to see how such a crude tool could have developed on the one hand into the plough pulled by animal power and on the other into the hoe. Certainly these two share great antiquity as agricultural tools.

Probably because of the difficulty of finding suitable forked branches with just the right shape and size, man seems to have early learned to join two or more pieces together to get the necessary shape. With minor improvements in methods of joining the parts, the development of the plough seems to have been stagnant for thousands of years. The next improvement was the addition of some sort of iron point to lessen the wear on the parts working in the soil. This has taken place comparatively recently and the Indian plough has not progressed beyond that stage.

About three hundred years ago, the modern development of the plough began. The mould board plough for turning the furrow slice seems to have been developed in northern Europe, probably in Holland, during the 16th century. Shortly after, it seems to have crossed the English Channel into England and by the end of the 17th century it was well established. It was at first strictly a wooden affair but by the end of the 18th century, plating or covering the share and mould board with iron was common practice.

Shortly after 1800, the manufacture of cast iron ploughs was begun in America and in England. About 1837 John Deere began to forge out steel plough bottoms from high carbon steel. These were turning or mould board ploughs designed to invert the furrow slice. By this time the old soil stirring plough had gone out of use in Western countries and no one thought of making anything except a turning plough. With rapid improvement in the methods and processes of manufacture and the materials used, the newer iron ploughs rapidly spread throughout Europe and those countries largely settled by people from Europe. Slight variations in the shape and sizes to suit the animal power available were made but no change was made in the fundamental principle on which they operate. By the latter part of the nineteenth century, inversion of the soil had become the basic operation in all seed bed preparation. Anyone who attempted to use other methods was considered slovenly and a poor farmer.

Late in 19th century, the disk plough was designed and came into use primarily for working certain sticky soils which would not scour on an ordinary mould board plough but could be dug by the disk. It was later found that the disk plough had considerable utility for hard dry ground, partly because of its long cutting edge and self-sharpening properties and partly because it could be loaded to secure penetration. The basic idea of inverting the soil was adhered to. The lack of a land side made wheels necessary and the whole design required rugged heavy construction which limited its use with animal power.

Twenty years ago, anyone in a Western country suggesting any other method of preparing a seed bed than by inverting the the soil as the primary operation was distinctly unorthodox. A rather rigidly adhered—to system of ploughing, harrowing, clod crushing, reharrowing and so on came to be advocated. The new science of agriculture was just coming into prominence. Its advocates saw what the better farmers did and advocated their methods as best practice. There was so much to be tested and experimented on that there was no time to determine by tests just what was the effect of each operation and whether all that were commonly practiced were indispensable or not. Like most problems involving chemistry, physics and biology intermingled, preparing a seed bed is a complex operation in its basic principles, though it may be relatively a simple operation mechanically. Definite recommendations as to practice must be backed by reasons if they are to be convincing. Unfortunately, the development of modern farm machinery was initiated and largely carried on by men without engineering training. The teaching of courses on farm machinery in the early agricultural schools was largely in the hands of agronomists. The result of all these factors was

that a considerable body of theory and teaching developed based on what "everybody knows", "it stands to reason" and field observations without checks or definite attempts to control all factors and determine the most important one.

So-called scientific agriculture developed in America and Western Europe, temperate zone climates. For the most part, the climate is moist, there being plenty of moisture at least at seeding time. The weeds to be fought are for the most part annuals, or rather easily killed where perennial by turning them under. Gradually the mould board plough came to dominate the whole of agricultural practice as the basis and foundation of all seed bed preparation. There has been discussion of when to plough and how deep but little suggestion of any thought as to whether the method of seed bed preparation might be changed. Any suggestion that a seed bed might be made by other methods than by ploughing, preferably by deep ploughing, was frowned on as rank heresy.

When improved or so-called scientific agriculture was introduced into India, apparently the reasoning was something like this: The agriculture of the West is the finest in the world; the basis of Western agriculture is the mould board plough; therefore, the hope of improving Indian agriculture rests on the introduction of the mould board plough. The two statements were probably fact but they did not prove the truth of the conclusion.

Most if not all the attempts to introduce improved ploughs have been attempts to introduce mouldboard ploughs. A few disc ploughs have been sold but nowhere have they won wide favour. Many attempts have been made to design a small replica of the larger ploughs which would be cheap and efficient. Many attempts have been made to adapt the smaller sizes of American and English ploughs by fitting wooden beams similar to the *desi* plough. Much labour has been expended in trying to induce the cultivators to buy and use these "improved" ploughs. A certain amount of success seems to have been attained in the south where apparently conditions are more favourable. While Government Agricultural departments have by expenditure of much effort succeeded in selling considerable numbers of such ploughs, the effort has been far more than could be put out by a commercial firm and the use of the improved ploughs has not become general by any means.

There must be an explanation of this comparative failure. The two stock excuses are the poverty of the villager and his "conservatism". No one suggests that it might be due to the ploughs being unsuitable. That is impossible since they are patterned on those in use in western countries. *In my opinion*

the one most important reason for our failure in introducing improved ploughs is the unsuitability of the models we have tried to introduce. In comparison with this, the poverty of the villager and his conservatism are unimportant. The cultivator has not accepted widely the new ploughs and where he has, he has used them for only a part of the work he has to do.

The ploughs are unsuitable in two respects, the design and the materials of which they are made. To discuss the latter first, most designs have emphasized the use of cast iron, chilled or not, especially for shares, in the belief that the cultivator would not have steel shares sharpened and that when the cast shares were dulled, they could be thrown away and a new one bought. This seems to have been a fundamental error. The cast share often broke due to some chance blow or to the plough being dropped. When broken or blunted, it had no salvage value. A steel share can be beaten into a *kurpi* or *ghandasa* blade or into various other useful things. Sharpening of small shares presents no difficulty to the ordinary blacksmith. That the cultivator has definitely rejected the cast share is proved by the small sales of replacement shares and by the fact that even in towns where new shares are available, the cultivator more often buys a scrap of old railway spring or other steel and has a share forged by his own blacksmith. In my opinion, the attempt to force a cast share on to the cultivator is doomed to failure, no matter how good the share.

Even more fundamental is the question of design. The mould board plough is handicapped in several directions in competition with the *desi* plough. The latter is almost a universal tool in that it is used for preparing the seed bed, seeding the crop and even for interculture when that is practised. One of the common objections cultivators raise is that the improved plough cannot be used for seeding either the kharif or rabi crops. Especially in connection with the rabi crop, a seedbed cannot be made with one ploughing and harrowing as it can be done in the Western countries. Repeated ploughing with mould board ploughs after the end of the rains results in the loss of too much moisture and is relatively ineffective as compared with other methods in killing some of the worst weeds, such as dubh grass and others which grow from root and stem pieces. These are much more effectively killed by some method which cuts them from the roots but leaves the tops exposed to dry.

In questioning the necessity for continually turning the soil over and over, the Indian farmer has only preceded recent scientific opinion in the West. Where formerly the mould board plough held the field undisputed, the coming of the tractor has brought the disc harrow, the field cultivator and the one way disc or harrow plough into active competition and these have almost dis-

placed the inverting plough in some sections and for some crops. It has been demonstratee that crops can be grown with less cost and no reduction—in many cases with a definite increase—in yield when the mould board or other soil inverting plough is not used. Experience during the last ten years with some of these implements has shown that much of what we knew about ploughing is either not so or of doubtful importance.

Our revised knowledge of ploughing, at least in India can be summarised a follows:

Reasons for ploughing in order of importance.

1. To kill weeds.

2. To facilitate getting the seed into the ground under favourable conditions for germination. (Good contact between moist soil and seed).

3. To loosen the soil and so facilitate the absorption of water from rainfall and irrigation.

4. To bury organic matter, if and when any is present.

When this much has been said, we have said all that can be said with certainty. Undoubtedly a rodent or a few white ants are killed occasionally. The number would rarely justify ploughing for the purpose. So-called "aeration" is not proved; any effect caused by it might be easily accounted for by holding organic matter in the shape of crop and weed residue, the catching by the rough ploughed surface of other similar organic matter blown from adjoining fields by high winds and by the full absorption of the first fall of rain which carries some fertilising elements from the air but is usually lost in India when the ground is dry and hard. Other reasons offered for ploughing are at best theoretical and not supported by experimental data and can be dismissed with the remark "not proved." Ploughing at the best time is definitely important but the importance of deep ploughing except possibly for root crops and sugarcane, is doubtful. In most cases, deeper ploughing gives an increase in yield at least for the first season or two. The increase in yield rarely equals the increase in cost when done with mould board ploughs. Increasingly, agriculturists have turned from the mould board plough to the field cultivator and the skimming or one-way disk plough both of which can be used to break up the surface to a moderate depth, without much turning of it over. This movement has been most pronounced in districts where climate most nearly approaches that of India and has been less in the moist cool climate of North-western Europe. If deep ploughing is to be done in India, the only important reason for doing it is to facilitate the absorption of rainwater especially early in the rain so as to store more water deep in the soil for later use.

With the foregoing discussion in mind, we can lay down the characteristics of a plough suited to Indian conditions. In my opinion, the desirable features are as follows:—

1. It should be able to stir the soil efficiently when the main object is to kill weeds and should cover the whole surface each time over the field.

2. It should be able to invert the soil when necessary to cover manure or green manuring crops.

3. It should be able to open up the soil with the least effort possible when it is hard and dry to facilitate the absorption of the first rains of the monsoon.

4. It should be as nearly a universal tool as possible, capable of being used for sowing and cultivating as well as for seed bed preparation.

5. It should be made of steel throughout or as far as possible. The use of wooden beams may be permissible at least for some time but the use of cast iron should be entirely avoided.

Having formulated these requirements, the Agricultural Engineering staff of the Allahabad Agricultural Institute found that there was no implement on the market to meet these conditions. We have attempted to meet them with our own design, the "Wah Wah" plough. We can now claim to have met every one of these requirements with this plough and its various attachments and to have done so at a moderate cost and in such a manner as not to require radical improvement in the bullocks ordinarily used before it can be adopted. It is essentially a small plough for use with small oxen on small holdings.

It is essentially a plough stock consisting of a beam and handle with which is combined a standard for carrying the various bottoms used. The beam is of wood similar to the ordinary *desi* plough, while the combined handle or standard and shank is of steel. For doing all the work of the *desi* plough except sowing, a heavy type of sweep or duckfoot is used. It is very similar to the sweep used for cultivators, being modified mainly by the addition of a patch point, replaceable when worn, which prolongs the life of the share as well as improving its usability. The addition of a 4″ or 2″ cultivator steel allows the stock to be used for seeding in the same way the desi plough is used, either with an ordinary bamboo spout or preferably one of thin iron pipe we make. This provides a complete substitute for the *desi* plough which will do all the work it does, preparing a seed bed in most soil, seeding and interculturing, and do it all more efficiently.

For use where a soil inverting plough is required, a small mouldboard bottom made of steel throughout and arranged to

attach to the same stock is available. For any who may prefer a cast share, it has been made to take the Ransomes Meston share interchangeably with the steel share furnished as regular equipment. Our experiments to date indicate that the plough works better with the steel share, the life of the share is longer, its effectiveness is increased by the possibility of resharpening and the danger of breakage is eliminated. It has been very highly recommended by cultivators who have used it so far.

For those who do extensive interculture, a cultivator attachment has been devised giving a three shank cultivator. So [illegible] the price of this attachment is not much below that of some of [illegible] small separate cultivators on the market. Its superiority lies [illegible] the greater range of adjustment and the different types of work which can be done with it. Combinations of cultivator steels, sweeps and furrow makers are possible so that most types of interculture can be practised with it. While smaller and covering less width, it will do practically every operation which can be done by the so-called bullock hoes. In addition to cultivation in the ordinary sense, the common bullock hoe furrow makers may be used even up to the large 20″ and bigger sizes for making furrows and ridges for planting sugarcane, potatoes and other crops grown in furrows or on ridges and for earthing up crops, greatly reducing the amount of hand labour required for this work. With its range of work in mind, it is considerably cheaper than any cultivator available which will do the same work.

Further experiments are in progress to develop a type of point or share which will most effectively dig up at least the lighter of the alluvial soils of the Indo-Gangetic plain during the hot dry season so as to get the known benefit of such work. We now have what we consider to be a practicable implement but further trials are to be made in the hope of further improving it.

In this plough and its attachments, we believe we have an important contribution to the improvement of Indian agriculture. It gives the cultivator a set of specialised implements, each specifically suited to a certain job, which can be purchased as a lot or a little at a time, removing the necessity of using a "universal" implement with attendant loss of efficiency in every operation. It is made of first class material and will have a reasonably long life. It is specifically designed and suited to Indian conditions, having been developed by men trained in Indian agriculture working in close co-operation with Indian cultivators who are now actually working their own land.

Possibly most important of all, it meets the conditions laid down in the first part of this paper as to the type of work to be done by a plough.

THE RANIKHET DISEASE OF POULTRY SUCCESSFULLY CONTROLLED

By Rev. B. C. Case, Superintendent, Pyinmana Agricultural School

The new "Ranikhet" poultry disease last year practically wiped out all the adult fowls in many sections of Burma so that the crow of the cock could not be heard in some villages. The disease is spreading again this dry season and methods of control which we have found successful at Pyinmana will interest poultry keepers elsewhere.

At the Pyinmana Agricultural School we had been very careful not to bring in any fowls from outside which might introduce the disease. However one day a pen of white Leghorn pullets occupying half a poultry house were found with the disease. There was a discharge from the mouth and nostrils, some sneezed occasionally and the bowels were loose. All the birds died in a day or two. The cockerels in the other half of the house, separated by wire netting were immediately removed and segregated, but in five days they started to come down with the disease and in a few days all died. Permanganate of potash to make a light red solution was put in the drinking water of all the pens, and all the feed was fed dry in hoppers inside the fowl house and burlap curtains were put over the entrance, so that while the fowls could go in, crows would keep out. No more birds in the adjoining pens were attacked by the disease.

How did the disease get started? Crows had been dying in the neighbourhood from the same disease. A large "kokko" tree was growing near our poultry houses with one large branch extended over the yard where the disease first started. Crows used to come and roost in this tree at midday. Apparently the droppings from some sick crow started the disease. I have cut down the tree and will permit only small low growing trees to remain in and around the yards, such as the guava, papaya, custard apple and plaintain. When the feed was kept outside in the yards many crows came. Now with the feed out of reach in the house they hardly ever come.

The experiences of my friends keeping poultry in the villages corroborates my own. Where crows congregate near chicken yards the disease readily starts and spreads through the flock. The liberal use of permanganate for prevention as well as for treatment of sick fowls this year they say has saved many birds where the flocks were wiped out last year. I think that possibly the young chickens which survived the epidemic last year, when full grown this year have become rather immune to the disease. It may be

similar to the case of tick fever in cattle where young stock have only a light attack as a rule and become immune to the disease for life.

I went to Insein and saw Mr. Smith, the Veterinary Research Officer who had been experimenting with the disease to see if an anti-toxin could be produced to counteract it. I found there that the annual reports of the Imperial Institute of Veterinary Research, Muktesar, had references to the disease for the past three years. The following facts which have been brought out by scientific study and the experience of poultry-keepers should be useful in controlling the disease anywhere.

1. The "Ranikhet" poultry disease is caused by an ultra-visible filter-passing virus which is discharged through the mouth, nose and intestines.

2. The virus is destroyed by soaking one hour in a permanganate of potash solution of 1 part to 5000.

3. Grown chickens are highly susceptible to the disease and 90 per cent or more die. Young chickens are not readily attacked or at least do not show such severe symptoms. Crows and pigeons are susceptible although I have not seen pigeons dying from it in the field. Ducks and geese apparently are not easily affected. Old fowls which survive become immune to the disease.

4. Poultry houses in which the disease has occurred if occupied within a month will cause the disease to reappear. If left vacant for over three months, the disease does not reappear.

5. It is hardly worth giving treatment to ordinary chickens which contract the disease. As soon as a bird is known to be infected it might as well be killed. An infected bird is a great source of danger to surrounding healthy birds. If one out of ten should recover they are seldom of much further use for breeding or laying.

6. The crow is the chief cause of carrying the disease far and wide. Do not keep poultry houses and yards near large trees where crows can congregate. Place all feed inside the poultry houses and cover the entrances with curtains so that crows will not get to the food.

7. Prevention is the best form of cure. Keep all poultry in yards where they will not come in contact with outside fowls. Have several yards and separate houses for one's own fowls, so that if one yard becomes infected all the birds will not be destroyed. Unless this precaution is followed all one's fowls are likely to be wiped out at any time.

Remember the sneeze of a chicken will carry the virus of the disease through the poultry netting of one room to another room

in the same house even though the birds do not come in contact with each other. Therefore it would be well to have partitions between different rooms of the same house as an extra precaution.

8. The liberal use of permanganate of potash is the only remedy now generally available for treatment. No vaccine for protection has yet been found. If the disease appears in the neighbourhood put permanganate in the drinking water to make it a light red colour.

(*Continued from page* 137)

In all these units there is a striving for reality, a desire to face the facts and from them to carry on an institution that will truly serve India. Because of the superlative values on the spiritual side of life the College seeks in all fair ways and by all honest means to share with its students the One who is the inspiration of all its highest endeavour, the One who gives the power to strive, to continue, to achieve, the One who by example and precept bade His disciples feed the hungry, give drink to the thirsty, clothe the naked, visit those in prison, set the captive free. Jesus bids us feed and relieve and free the bodies of men, the minds and the spirits of men, and so as we serve India in His name we glory in the Allahabad Christian College and wish for it a long and useful life.

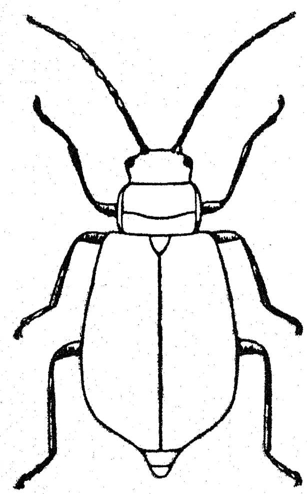
There is no short road to real progress in the breeding of better dairy cattle. Records alone can give us a sound guide for a selection of a cow's productive inheritance. We must breed cattle whose high producing ability is a true and fixed character and not just a chance combination of factors. This must be done not alone in a few individual herds but in every herd of dairy cattle in (India). A constructive breeding programme based on fact, not fancy and sentiment is the road our cattle breeders must travel.—*Abstracted from Hoard's Dairyman April 10th*, 1934.

In certain green-houses in America, employees are not allowed to use tobacco or cigrettes, or carry a slug of chewing tobacco, while working with tomatoes, as it is claimed that this helps the spread of mosaic disease in those plants.

THE ORANGE-RED PUMPKIN BEETLE

(Aulacophora abdominalis).

By W. K. Wesley, M. Sc., L.T. Entomologist.



This is a deep orange-red coloured beetle about $\frac{1}{4}''$ in length. It is observed all over the United Provinces and is a pest of cucurbitaceous plants, cucumbers, gourds, etc. The beetle bites off the leaves and the flowers of these plants and proves harmful, specially to the young plants.

The female beetle lays very small, spherical, yellow eggs in the moist soil, round about the roots of these plants. In about one to two weeks' time, small, whitish grubs hatch out of these eggs which may sometimes bore their way through the stems and fruits lying on the ground. In such cases they prove very harmful. The grubs are full-fed in about two to three weeks. They, then, pupate in the ground in special oval cells made of earth. The pupa stage lasts from one to three weeks, after which the adults emerge as deep orange-red coloured beetles.

Ordinarily the beetle lives for about a month and then dies but those beetles that hibernate under the shelter of leaves, grasses, cracks in the ground, etc. to protect themselves from the cold in the months of December and January may live longer. These are the ones that cause greater danger.

These beetles that come out of hibernation about the month of March are the most destructive and are the source of future trouble. Every effort should be made to destroy as many of the eggs, the grubs and the beetles as possible, right at this time, otherwise they get out of control. The farm boys may be trained to distinguish the eggs and the grubs and destroy them. The beetles are also very few at this time and can be destroyed through hand-picking.

The farmers and vegetable growers generally leave the creepers in the field after the crop has been harvested and these provide the most suitable hibernating place for the beetles during the cold months. If these, instead of being allowed to remain in the field scattered all over, are pulled out and accumulated in a heap at one place and when the beetles have taken shelter in it, be set on fire together with the addition of a little dried straw, a great deal of future trouble will be saved.

Young plants are the ones that require the protection most and these may be saved from the attacks of these beetles by sprinkling the leaves with dry ashes to which a little kerosene oil has been added just to give a smell. Lime and tobacco dust diluted with ashes or fine road dust can also be used instead of the above. Strong tobacco decoction poured round the roots of the young plants also kills the grubs very efficiently. Paris-green mixed with ashes or fine road dust in the proportion of 1:8 and dusted over the leaves proves fatal to the adult beetles.

For the use of the dusting powders a dusting machine is needed but in the absence of one, any receptacle may be utilised. Dusting mixture is first introduced into this receptacle and then the mouth is tied over either with a piece of muslin cloth or wire gauze and the powder is then dusted over the leaves in the ordinary way. Two of these receptacles may be tied at the two ends of a rod and a double dusting may be effected at one time.

Much mischief, done by a large number of crop pests, can be avoided through right and timely ploughing and safe disposal of crop remnants.

(Continued from page 158)

Vitamin C is unfortunately adverse to remaining in a food when it is heated, especially in the presence of alkalinity, while on the other hand, an acid medium seems to successfully seal the vitamin in the food, even during heat application. This is why canned tomatoes retain their vitamin C properties, and pasteurized milk and cooked cabbage and spinach lose them to a great extent. Many cooks sacrifice the vitamin while retaining a more attractive colour in green vegetables by tossing in a bit of soda.

I wonder how many of us are labouring under the delusion that when we gulp down a few bitter forkfuls of dark, unappetizing spinach, that we are satisfying our need for vitamin C? Would you like to know how to cook spinach in such a way that it will be bright green in appearance, appetizing and tasty, and literally chock-full of health-giving vitamin C? It's very simple and the first secret is not to overcook it as is so often done. This makes it dark and bitter and detracts greatly from the nutritional value. First clean and wash the spinach well to remove the sand; add to the leaves a cup of boiling, salted water for every pound of spinach, and cook for six minutes. Seasoned with butter or bacon drippings, spinach will present a new side you never suspected.

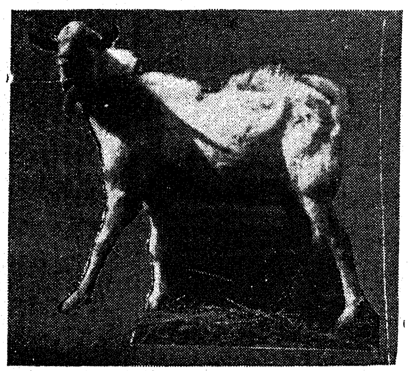
Pale, languid ladies, take a tip from modern nutrition and enjoy better health.

KEEPING MILK GOATS IN INDIA

Chapter I.

Goat's Milk

The lack of a sufficient quantity of milk in the diet of a great many people in India, especially the poor, often results in their not having developed in their bodies the strength or stamina which enables them to resist disease. This applies more especially to growing children but it is also true of adults. Milk is the very best of all foods because it has in it all those different substances in suitable proportions which are required by the body for building up and maintaining strength and health.


Good Surti Buck

From the very earliest times the goat has been used by people as a source of milk. Even before cows became domesticated, sheep and goats were kept and their milk used for human consumption. In India to-day there are very large numbers of these animals, there being scarcely a village or hamlet where they are not found. But instead of their now being used so much for milk purposes most of them are kept for slaughtering purposes, or the sheep for both wool and mutton purpose. Sheep have never been quite so useful from the point of milk supply because goats have always produced more milk, although they have not been improved in this respect nearly as much as they might have been. This is a great pity, for the goat gives excellent milk and, with proper treatment, might easily become the 'poor man's cow.'

Goats milk is especially valuable because it more closely resembles human milk than does cows or buffaloes' milk. It is also more easily digested than such milk, for the fat globules particles in it are much smaller and can thus be more easily 'attacked' by the digestive juices than can the fat particles in cow's or buffaloes' milk. Then too, it has an alkaline reaction during digestion, which is not true of the other milk. This is a very valuable property for it helps to kill the germs found in such diseases as common colds, influenza and bronchitis. Finally, because goats eat the green leaves of many different plants in the hot weather, when there is no green grass available for cows or buffaloes, they get valuable properties in their milk from these green leaves that cows and buffaloes do not get at that time of

year. In many parts of India the big strong wrestlers recognize the peculiar value of goats' milk, preferring it to any other kind of milk. Why should others not be as wise?

Some people, however, object to goats' milk because, they say, it has an unpleasant odour or flavour. True, it may have such an odour or flavour if the milk is drawn under insanitary conditions, or left to stand where impure odours exist. Another important reason for bad odour or flavour is the presence of the male goat in the near neighbourhood where milking is being done. The odour from his body is easily carried to the milk and thus spoils the milk because milk of any kind has the property of absorbing odours very readily. And the odour of the male goat is unpleasant, to say the least. Therefore, all male goats should be far removed at milking time.

Of course, cleanliness when milking any animal is most essential. The animal should be brushed clean and the udder carefully washed and dried, while the place where the milking is being done should be free from all filth and rubbish of every sort. The vessels into which the milk is to be drawn should have been washed thoroughly with warm water and then 'sunned,' immediately after the last milking. One's own clothes and especially the hands should be very clean. All this means trouble but it also means good clean milk and freedom from bad odours. Let one milk the goats in this manner and the complaint referred to above will not be heard again. In fact, it will be found that goats' milk can hardly be distinguished from cows' milk. It has a sweet wholesome flavour.

Goats, in fact, are as a rule clean animals more so than the ordinary cow or buffalo. Unless almost starved, they will not eat refuse or dirty garbage. They will choose only clean food. It is very rare indeed that goats are affected by tuberculosis but the same cannot be said with such confidence about the cow or buffalo. And the chief reason for that probably is that the goat is so much more cleanly in its eating habits. One is often led to think that the village buffalo is a filthy scavenger, as one sees it eating all kinds of objectionable things. That cannot be said of the goat. See for yourself if this is not true.

Another advantage of the goat is that it is a small animal requiring but little space for its keep. Goats do like exercise but if thay are given only an hour or so to run about in the morning or evening, and then are kept tied or tethered all day, with food and water supplied to them in sufficient quantity, and a shady place in which to rest during the heat of the day, they will get on very well. If one has good opportunity to graze them in rough hilly country, or to let them roam about the fields after the crops

have been harvested, they will enjoy such freedom. But it is not absolutely necessary. And one must be careful to prevent them from doing harm to one's neighbour's crops or trees. Again, too much freedom may mean that they are expending so much energy running about that they do not have sufficient left to produce the abundance of milk that one expects. Therefore, a moderate amount of exercise is better than too much, provided one is careful about supplying the feed and water they require.

Now, the reasons given above should be sufficient to show that the milk goat ought to be a popular and useful animal, especially amongst the poor in India. In many Western countries, notably Switzerland, France, England and the United States, it is so regarded and there are a good many books and even magazines published dealing with the subject of these animals. Goats are treated with affection by many and they thus become pets as well as useful members of the communities in which they live. In those Western countries there are goats that give anywhere from two to ten seers (4 to 20 lbs.) of milk a day. In India there are goats that give as much as from two to five seers (4 to 10 lbs) but they are rather rare. An ordinary country goat will do well to give one seer, or even less. It would be possible to have many thousands more of good milk goats by paying attention to the following points;

1. Proper breeding.
2. Proper feeding.
3. Proper housing.

There are other matters that also need to be considered but the principal ones are those just mentioned, and they will now be taken up in the order given above.

(Chapter II will appear in the next issue.)

"There can be no sunshine without shadow.

"Civility costs nothing and buys everything.

"The mouth of a wise man is in his heart; the heart of a fool is in his mouth, for what he knoweth or thinketh he uttereth.

A man who never makes a mistake will make nothing.

The poor are not those who have little, but those who want much.

To enjoy riches, do not set your heart upon them.

"Education is the harmonious development of all our faculties- It begins in the nursery, and goes on at school, but does not end there. It continues through life.

THE CLIMATOLOGY OF POTATO

By B. M. Pugh, B. Sc., Ag. (Calif.)

There is a great deal of confusion as to whether this plant succeeds best in a cool or a warm climate. Percival, an English botanist, states that the plant is best suited to a warm and comparatively dry climate. Others again, especially in America, maintain that the contrary is the case.

If we consider the origin of this plant and the places where it is still found in the wild state, I am sure that it will throw considerable light on this matter. There is no doubt that this plant is of South American origin. A wild species of this plaint is still found in Chile (South America). Some also maintain that this wild species of the plant is found in Peru on elevations as high as 11,000 feet. At the time when America was discovered the Chilean and the Peruvians were cultivating these plants in temperate regions only at varying altitudes which vary with the latitudes of the place. Thus in regions which were closer to the equator, the altitude of the region in which potato was, was higher than in regions away from the equator.

When we examine the climate of these countries we find that it may be classed as cold. The normal surface temperature of these regions in January is below 50° F., and in July 32° F. Again the rainfall in these regions varies from about 10 inches on the higher altitudes of the Andes to about 100 inches in the Southern coast of Chile. Also the altitudes of these regions vary from the sea-level in the southern part of Chile to over 10,000 feet in Peru, and parts of Bolivia, where this plant has been known to exist in the wild state. So although Peru is within the torrid Zone, the higher altitudes of the regions render the climate cold and the crops that are grown in these regions belong to the temperate zone.

Since the introduction of this plant into the old world by the Spaniards—the story that Sir Walter Raleigh brought this plant into Europe from America is very improbable,—the plant has thrived best in countries which are farther away from the torrid zone. The countries in Europe now leading in potatoes are Germany, Russia and France, arranged according to the size of their output. In the United States of America, the five leading potato states, Minnesota, Wisconsin, New York, Main and Michigan all touch the Canadian border.

When this plant was first introduced into India during the Government of Warren Hastings, it was cultivated in the hilly districts of Assam, near Cherrapunji, a small town famous for its heavy rainfall, amounting to 450 inches annually. Since then,

potato-growing has spread all over India. However, the Khasi hills districts in Assam where the average rainfall is about 80 inches annually is one of the most important centres of potato-growing in India.

If one studies the yield of potatoes per acre in different countries of the world, he will find something like this: Belgium leads with an average yield of about 275 bushels per acre. Then comes the Netherland with about 265, Denmark with 232, Great Britain with 217, Germany with 203, then Sweden and Canada with about 165, then South America with about 60, then Spain with about 128, France with about 127, then Russia with about 112, Italy and the U. S. A. with about 94 bushels each. These figures are interesting. A study of them will show that on the whole, those countries with a lower temperature in July have a higher yield. The month of July is regarded as the critical temperature period in the life of the potato plant. The yield of potato per acre in Sweden and Canada are again about the same. This is indeed surprising when we know that Sweden lies in the same altitudes as Canada. The latitudes of Italy also correspond with those of the United States. One, however, cannot go too far in making these comparisons. The different types of soils and cultural practices are also important factors in determining the yield of any crop. And this is very true especially in the case of potato. Again, if we study the above figures we shall see that while Sweden produces only 165 bushels per acre, Belgium which is in lower latitudes produces as much as 275 bushels per acre. This may be due either to the amount of rainfall that these countries receive or even on the latitude of the place, because there must be the latitude, north of which the potato plant cannot thrive well, as there is one, south of which the potato plant cannot grow.

In order, therefore, to determine the effect of climate on the yield of potatoes, one should try to eliminate the effect due to all other factors. This is only possible in small areas where one can get the data on the temperatures, the amount of rainfall, the latitude or the altitude of the place, the types of soils and also the cultural practices in the area. The figures given in the 1923 Year book of the United States Department of Agriculture, of the yield of potatoes are very interesting. If we take the unirrigated states we find that Maine which lies on the highest latitude has the highest yield per acre, a yield of 196 bushels per acre, compared with only 94 bushels for the whole of the United States. And comparing this with those states in which the soil type is similar, we find that it is followed in order thus: New Hampshire (212), Vermont (121), Massachusetts (118), Rhode Island (118), Connecticut (104). This is almost in the descending order of latitudes. The lowest yielding states are those situated near the equator

like Texas with only 59 bushels; Louisiana, 65; Oklahoma, 66; Georgia, 69; and Arkansas, 71.

In India, potato is confined mostly to the hilly places like Simla, Darjeeling and Shillong. But when grown in the plains of India it is mostly a winter crop. In Allahabad the mean temperatures in those months when potato is grown are as follows: November 67·5°F., December 59·8°F. In Darjeeling the mean temperatures in those months when potato is grown are as follows: March 49·7°F., April 56·2°F. May 58·3°F., June 59·9°F., In Shillong the mean temperatures during the growing months are as follows: February 51·8°F, March 60°F. April 65·5°F, May 66·6° F. The mean monthly temperatures at Simla also during the growing months vary from 50°F to 66°F. These figures seem to show that potato would develop best in those regions where the mean temperatures are not too close to freezing point and where the temperature is not beyond 70°F. Potatoes grown in Darjeeling and Shillong are also harvested before the heavy rains in June and July start in. For while the plant needs plenty of moisture, yet it would appear that high humidity in January or February in Allahabad or in April or May in Shillong is conducive to the development of potato bight (phytopthera infestans), which is one of the most common and also the most serious diseases of potato. It was the attack of this fungus which caused the famine in Ireland in 1845. Thus fungus which causes the disease while it seems to live over from one year to another in a field where potato is grown, in such places as Darjeeling and Shillong where the climate is fairly cold; it does not seem to outlive the high summer temperatures of Allahabad. It is also claimed by certain plant pathologists that the disease does not occur where the mean temperature exceed 77°F., but a fall of temperature below 60°F. is very liable to start an attack.

The storage of potatoes for seed purposes in the plains of India is a very serious problem, because of the high temperatures during the summer. For proper storing of potatoes the temperature of the store-room or cellar should be between 34° to 42°F. And while dry air during the process of storing is injurious to potatoes as it increases evaporation, high humidity again increases the development of storage the temperatures should therefore be kept low and the humidity should be controlled by uniform air circulation.

Mr. T. K. Titus I. D. D. of the class of 1928, who until recently had been working in the dairy of Mr. Gandhi, in the Sabarmati Ashram, was recently married in Madras. We offer him our congratulations.

DO YOU EAT YOUR SPINACH (HINDUSTANI: PALAK) TO OBTAIN VITAMIN C?*

By Lois Huff.

Many of us little realize that the cause for ill health, irritability, lack of stamina, or defective teeth, is due somewhat to a deficiency in our diet, namely vitamin C. Vitamin C is the antiscorbutic vitamin, that is, scurvy preventing. The symptoms named above are not indicative of scurvy itself but of a lack of vitamin C. Scurvy is practically unknown in this civilized country, except in extreme cases. However, the above symptoms are very common, and many of us overlook the fact that the body is fairly shouting its need for this elusive substance. Perhaps you are bewailing the fact that increasing age has rudely bestowed rheumatism in your joints; your trouble may be synonymous with that of adolescents who suffer "growing pains", which are most probably due to lack of vitamin C.

And now that most of us are "vitamin-C-minded", let us search through our diets and determine what foods are supplying us with vitamin C. Here is a sample of what most of us like for Sunday dinner: a fruit cocktail, probably canned fruit; we eat greedily of meat, and perhaps potatoes. We eat part of our cabbage salad and leave the lettuce. A spoonful of spinach lies unnoticed. A sweet dessert disappears speedily. Alas for vitamin C. It is lost in the shuffle, the most of it lying discarded on our salad plate. This is a typical winter meal, when fresh fruits and vegetables are not in abundance, and yet many of them that may be served are neglected.

Foods which yield this precious vitamin are not so scarce as to excuse neglect. Citrus fruit juice and tomato juice are perhaps best known and may be used interchangeably. Most fresh, succulent vegetables are excellent sources, especially if eaten raw. Milk is a good source if it has not been subjected to heat or pasteurization. The daily amount of vitamin C to insure protection from scurvy has been estimated as that amount contained in one ounce of orange, grapefruit, lemon juice, canned tomato, raw cabbage, or onion; or in one pound of cooked cabbage or potatoes, or in a pint of raw milk. However, it is imperative to good health that we allow ourselves more vitamin C than just enough to prevent scurvy—and this means selecting more foods of vitamin C content, which in addition, will yield other beneficial properties.

The vagrancy of this vitamin should not be left unmentioned.

(Continued on Page 151)

**A reprint from the "Agricultural Student" March, 1934.*

DOKRAS COTTON.*

[By M. R. Dokras, B.A. (Botany), LL. B., Chandur]

Being interested in the work of cotton breeding since 1928, when I read that "each district should have a strain of cotton suitable for its climate in the growing season," I decided to find out for myself a strain of cotton suitable for my district. The local cotton, then popular in this district, on account of its greater outturn, contained a mixture of Garre Hills cotton plants, though deteriorated after several years of crossing with plants of other local varieties. The whole mixture was short-stapled and was sold in Bombay market under the name "Oomra cotton." I wanted to have before me some ideal to attain to and one to which all my efforts should be directed. I decided that the Nagpur Bani, reputed to be the best amongst the indigenous varieties should be that ideal, so far as length, fineness and strength of staple were concerned but that the standard of outturn should not be less than the local mixed variety, nor should it prove inferior to the local variety in point of ginning percentage also. All these points were necessary and important to satisfy the cultivators and traders, who are chiefly interested when a new strain reaches its marketing stage. 35 p.c. of lint was fixed upon by me as the standard, that being the percentage of lint in the local variety.

With these ends in view, in the monsoon of 1929, a plant which I considered to be a natural cross of G. H. Bani was selected by me for future multiplication. It was a tall plant, more than six feet high, which had fully developed all the 32 bolls it bore and gave fine and strong lint, nearly one inch in staple. From this plant and its successive generations selections were made in the following seasons and in 1934 the best quality of seed available for sowing has reached the extent of 15,000lbs. The strain has thus reached its marketing stage and is now named as "Dokras No. 1". Its ginning percentage is however only 29. As the yield is better than that of other local varieties what is lost in ginning p. c. is more than made up by the increase in the price received. This strain fetched a premium of Rs. 20 above Broach in the local market in 1932 and in 1933 it was sold at par in Broach as some of the pickings were rain-damaged. The Director of the Technological Laboratory at Matunga certified in 1932 that it would be only slightly inferior to Verum in spinning. The price received in those seasons was Rs. 12 and Rs. 5 respectively, more per khandi than the price of the local cotton in the market on the date of the sales.

Being encouraged by the success thus far achieved but not

*Reprint from the Hitavada 3-5-1934.

satisfied with its ginning percentage. I continued my work of further selections of bolls from plants showing marked superiority in ginning percentage over the first strain, keeping up the fine lint character also in view. For this end I purchased and sowed in my field seed from stapled locks or bolls of cotton produced in the fields of other cultivators who were sowing the G. H. mixture for many years past, thinking that in this way I would come across a natural cross, more fixed in its characters by several years of natural selection preceding my experiment with the same. The seed from these selected bolls was sown in the next season and the process was repeated till last year. This year I have got seven crosses which seem to have in some period or other G. H. as their ascendant and produce tall hardy plants, producing big bolls with fine and strong lint and also give good outturn as they are selections from parents which themselves were heavy producers under local conditions.

Dokras No. 1 being the first selection, the yield, the lint length, fineness and strength, and the ginning percentage improves gradually in each strain till we come to one named "Dokras No. 11" which is the best of all. The Director of the Technological Laboratory in his report dated 5th April, 1934, on its test certifies that "it possesses 15 p. c. longer and finer lint than Verum 262—its intrinsic strength being much higher than Verum, and that it has the same mean fibre length and mean fibre weight per inch as last season's Bani grown in Nagpur and that it is adjudged suitable to spinning up to 33· standard warp counts." As regards yield, Dokras No. 11 has this season, though a bad one, reached the extent of 1,000, lbs. per acre, the ginning percentage being full 35 p. c.

All this will prove that the value of this strain is about 1½ times more than the present bazar cotton and thus the ideal that I had in view from the beginning was fully realised during this season. This strain has kept up all the desired characters in the generations of 1932 and 1933, and there is now little fear of its deteriorating to its predominant G. H. ancestor. Selections are however necessary to be made for about two years more in order to turn it into a pure line selection. By this time the strain is also likely to reach its marketing stage.

I am a pleader by profession and was lucky indeed to find out this mutation, only after five years' work during leisure hours and now pray to the same Goddess of Good Luck to help me further in maintaining this as well as the other strains up to the present standard and multiplying their seed till the benefit reaches the general mass of cultivators. The magnitude of the work bewilders me; but I hope it will be accomplished with the help of the Departments of Agriculture in the various provinces and other public bodies interested in this part of the work of rural uplift.

INDIAN CENTRAL COTTON COMMITTEE,
TECHNOLOGICAL LABORATORY, MATUNGA
Fibre Test Report No. 86

On a sample of Dokiras 11 cotton submitted by M. R. Dokras Esq.

I. Fibre Particulars.

1. Fibre-Length Distribution (Balls sorter):—

Mean group-length in eighths of an inch	Percentage.
2	0
3	2·0
4	3·4
5	8·4
6	18·1
7	26·5
8	25·5
9	11·7
10	4·4
11	...

2. Fibre-Length (Inch):—		
(a) By Ball's Sorter	...	0·89
(b) By Baer's Sorter	...	0·92
3. Fibre strength (oz.)		
(a) By Ball's Tester	...	0·184
(b) By O'Neill's Tester	...	0·167
4. Fibre-Weight per inch (millions of an ounce)	...	0·164
5. $\frac{\text{Fibre Strength}}{\text{Fibre-Weight}}$		1·7

II Remarks

Dokras 11 is about 15 per cent. both longer and finer than the Standard Verum 262 of 1933 34 grown either in Nagpur or Akola. It has the same mean fibre strength as Verum but its intrinsic strength is much higher. It possesses very nearly the same mean fibre-length and mean fibre-weight per inch as last season's Bani grown in Nagpur. According to these fibre-properties, this Dokras cotton is much superior to Verum 262 cotton and is adjudged suitable for spinning up to 33's standard warp counts.

(Sd.) R. P. Richardson,
Offg. Director,
Technological Laboratory.

Dated 5th April, 1934.

FRUIT PRESERVES

By A. D. Chand.

Apple Preserve.

Apple ...	... 1 lb.	Alum ...	... 2 oz.
Sugar ...	... 1 lb.	Cardamom	... ½ oz.
Rice Flour	... ½ lb.	Rose Water	... 2 oz.

There are numerous kinds of apples grown in different parts of India, some are specially good for table use, while others are insipid and hardly fit to eat raw. There are a few other types with various degrees of astringency, which are used as vegetabbes in certain parts of India; specially in the Montgomery and Multan districts. This kind of apples, due to the high degree of acid makes very toothsome jelly. They are not good only making jelly but they also make a very lovely preserve.

The insipid types of apples, being less popular for table use, may however, be turned into a very delicious preserve.

Process.—Select unblemished, wholesome apples; wash, peel and core them. Cut them into two or four pieces according to size. Make ten or fifteen incisions on each piece and steep them under cold water if insipid, and in salt water if astringent for about four hours. Wash them with fresh water and boil them in a solution of rice flour and alum, until the pieces are soft and translucent. Transfer them to a cold water basin.

Prepare a thin syrup and when cooled down, add the prepared apple slice after thoroughly draining them. Then start cooking on a fairly slow fire until the syrup reaches the required consistency. Near the end point add powdered cardamom minor and rose water and mix them up thoroughly. Remove it from the fire and cool it slightly before putting it in the containers. If the preserve is sealed air-tight, it will keep for a very long time. The preserve can be used in making ice cream also.

Wood Apple Preserve.

Wood Apple ...	... 1 lb.
Sugar ...	... 1 lb.

Process.— Use only half matured or green apples, because fully matured apples do not make good preserve. Break the hard, shell-like coat of the fruit; take the inner pulp and cut it into thick circular pieces under water. Core out the seeds and after making

a sufficient number of incisions, steep them in cold water for an hour or so. Draw off the water and shake off the adhering water from the apples.

Have a thin syrup of sugar ready, transfer the fruit into the syrup, and allow it to simmer on a slow fire cutting away the scum as it appears. When the syrup becomes thick, remove it from the fire and seal it when cool.

It is a very popular preserve from the medicinal point of view and is supposed to be curative for dysentery, diarrhoea and many other diseases of bowel disorders. Indian physicians usually prescribe it for the above-mentioned diseases.

Pine Apple Preserve.

Pine Apple	...	... 1 lb.
Sugar	...	... 1 lb.

Process.—Use sound fruits only. Remove the skin, the eye and the central pithy portion of the fruits. Cut the fruit into an inch cubes. Spread them in a single layer and sprinkle sugar over them. Arrange similar layers one upon the other alternately stewing with sugar. Put the container in the sun; the water will exude from the pieces and will dissolve the sugar. Now place the pan over a slow fire and cook the fruit without adding water. Repeat cooking, without adding water, for about four days.

Then prepare a rather thick syrup with the remaining sugar and introduce the cooked fruit into it. Cook it further unless the syrup becomes the consistency of honey. Remove it from the fire and put it in wide-mouthed bottles.

Rose Apple Preserve.

Rose apple	...	... 2 lb.
Sugar	...	... 1½ lb.

Process.—Secure uniform, well ripened, sound rose apple. Remove the green tips from both ends, guarding against making any hole; otherwise the fruits will absorb salt when they are soaked in the salt solution. Soak the entire fruit in the salt solution for about an hour; remove the fruits from the salt solution; wash them with fresh water. Boil the fruits in clean water until they become tender.

Have a thin syrup ready; add the fruits and let it simmer over a slow fire until the syrup becomes viscous. Remove it from the fire and let it cool before bottling.

Pear Preserve.

Pear ...	... 1 lb.	Alum ...	... 2 oz.
Sugar...	... 1 lb.	Cardamom minor ...	$\frac{1}{2}$ oz.
Raisin	... $\frac{1}{4}$ lb.	Rose water	... 2 oz.
Rice flour	... $\frac{1}{2}$ lb.		

Process.—Take the best pears, peel them carefully and cut them into halves. Remove the seeds and the hard central part. Make incision all over the pieces; not exceeding more than ten on each and steep them in water for about two hours. Take the fruits out from the cold water and boil them in the solution of rice flour and alum until the pieces become quite soft. Remove the fruits with poddle to a basin of cold water.

Prepare a thin syrup and after draining and shaking off the water from the pear, put both pears and the raisin in the syrup, allow them to simmer on a slow fire until the syrup becomes fairly thick. At this point add powdered cardamom minor and rose-water. Blend them together; bring the preserve to boil and then remove it from the fire and bottle when it is still hot.

Jack Fruit Preserve.

Jack Fruit ...	... 1 lb.
Sugar ...	... 1 lb.

Process:—Jack fruit can only be preserved when it is fully ripened. Remove the thorny skin of jackfruits. Cut open the fruit and pick out the crisp flakes from the fibrous stuff of the fruit. Remove the seed from the flakes; make a few incisions on each with a pointed fork and soak them in cold water for an hour or more. Skin off the flakes and drain off the water. Bring some water to a boil and introduce the flakes to it and continue boiling until the flakes have become tender and transparent. The flakes should be boiled to just the right point without mashing them up and then put them in a sieve, allowing the water to run off.

Now make a thin syrup ready with a requisite amount of water and while boiling add the prepared flakes to it. Cook gently over a slow fire until the right consistency is acquired. Then remove it from the fire and seal air-tight in wide-mouth vessels.

Banana Preserve.

Take any edible type of banana, preferably Marthan or Green Bombay. Select unbruised, unblemished, fully ripened; but not soft bananas; remove their skin and cut them into two or three

pieces according to their length. Make just a few incisions on each piece; wash them with cold water and shake off the adhering water.

Make a thin syrup of sugar and adequate amount of water; and as the syrup is boiling, add the bananas to it and let it simmer over a moderate fire. When the fruits are well pregnated with sugar and the syrup becomes viscous, remove it from the fire and bottle it in wide-mouth vessels.

Apricot Preserve.

Apricot	...	...	1 lb.
Sugar	...	...	1 lb.

Process:—Obtain clean, unbruised apricots; wash them and soak them in salt solution for about two hours. Remove them from the salt solution; wash them again and boil them in fresh water until tender. Transfer the apricots to a sieve and allow the water to drain off.

Now prepare a thin syrup and put the apricots in it and cook it over a slow fire, until the desired consistency is reached. Take it off from the fire, cool and seal it in glass jars.

This preserve is medically very beneficial for the general tone of the body and is specially prescribed for persons of weak constitutions. Only two preserved apricots a day are sufficient to introduce a new vigour and strength to the body.

Currant Preserve.

Currant	...	1 lb.	Salt	...	1 oz.
Sugar	...	1½ lb.	Lime juice	...	1 oz.
Curd	...	¼ lb.			

Process:—Sort out the best currants. Clean them and soak them in water in an earthen ware for about two hours. Drain off all the water from the currant and spread them in a sieve and dry out the adhered water. Prepare a desirable amount of whey by mixing the curd in water or obtain sour butter-milk. Soak the currant in the whey or butter-milk for an hour and then boil the whole, until the whey becomes discoloured. Draw off the whey and wash the currants with clean water. Now add salt and lime juice and the remaining curd to the currants and blend them thoroughly.

Prepare a syrup of thin consistency; introduce the currants to it and cook it gently, stirring as it would require. When the

syrup becomes thick, remove it from the fire and bottle it.

It is a dainty, delicious preserve and is commonly used in manufacturiug cakes of the high qualities. It is a very nutritious diet. It has a stimulating and invigorating effect and is an excellent tonic for the emaciated convalescents.

Grape Preserve.

It involves a very delicate process and careful handling to make a good grape preserve, because there is every chance of mashing up the grapes. Mashed up grape preserve is more or less identical to inferior kinds of jam, and is very unsightly and highly undesirable.

In order to make good preserve, one must master the general principles of preservation discussed in one of the previous "Allahabad Farmer" numbers. In order to preserve grapes successfully a certain amount of experience is invariably required.

A trial should be made with just a small amount and after acquiring a reasonable success the same principles may then be employed in producing preserve on commercial basis.

Process:—Select half—matured grapes of any variety available except black types; because the preserve of black grapes is not attrractive in appearance; although it may be equally good in taste and flavour.

Clean the grapes, reject the injured and rotten ones and take only the best possible. Wash them properly in cold water for an hour.

Then prepare a very thin syrup of sugar with an adequate amount of water. Cool the syrup to a certain extent; introduce the grapes to it; and continue cooking over a very slow fire. Care should be taken as not to mash up the grapes. When the syrup becomes fairly thick remove it from the fire and cool it before bottling.

This preserve is very nutritious and very good specially for invalids.

FARMING BY NATIONS

"Which country has the largest percentage of people employed in agriculture? In the United States and in Switzerland it's about 26 per cent. of the population. In Italy the percentage is 55, in Germany 35, in Denmark 44, in France 41, in Ireland 43, in India 71, and Sweden 40."

Hoard's Dairyman March 25, 1934.

METEOROLOGICAL OBSERVATIONS AT THE AGRICULTURAL INSTITUTE FARM, ALLAHABAD

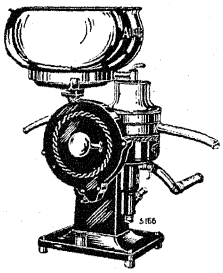
April, 1934

Date	Maximum temperature	Minimum temperature	Mean temperature	Percentage of humidity	Atmospheric pressure in inches	Rain for the day	Rain since January 1	Wind direction	REMARKS
1	104°	67°	85·5	18	29·47	..	1·74"	W.	Harvest of *arhar* begins
2	100°	66°	83·0	20	29·44	..	,,	W.	
3	100°	67°	83·5	25	29·42		,,	S.	
4	103°	70°	86·5	24	29·46	..	,,	W.	End of wheat harvest.
5	102°	69°	85·5	26	29·48		,,	W.	
6	101°	68°	84·5	23	29·55		,,	W. S. W	
7	102°	67°	84·5	20	29·46	.	,,	W. S. W.	
8	104°	68°	86·0	24	29·42	..	,,	S. W.	
9	108°	72°	90·0	22	29·44		,,	W.	
10	108°	74°	91·0	25	29·36	..	,,	W.	
11	108°	75°	91·5	62	29·34	..	,,	E. N. E.	Harvest of *arhar* ends.
12	104°	77°	90·5	61	29·46	..	,,	E.	
13	105°	77°	91·0	37	29·44	..	,,	N N. E	
14	105°	77°	91·0	25	29·46		,,	N. N. E.	
15	104°	78°	91·0	20	29·52	.	,,	W.	
16	101°	68°	84·5	12	29·42	..	,,	W.	
17	100°	65°	82·5	22	29·46		,,	S. W.	
18	100°	63°	87·5	22	29·44	..	,,	Calm	Harvest of water-melons begins.
19	101°	69°	85·0	30	29·40		,,	Calm	
20	102°	73°	87·5	50	29·38	..	,,	E. N. E.	
21	94°	70°	82·0	26	29·40		,,	S. E.	
22	107°	70°	88·5	20	29·38		,,	W.	
23	106°	72°	89·0	13	29·33		,,	W.	
24	106°	70°	88·0	26	29·34	.	,,	W.	
25	105°	78°	91·5	22	29·33		,,	W.	
26	104°	74°	89·0	20	29·39		,,	W.	
27	103°	71°	87·5	16	29·40	..	,,	W.	Last day of digging hill potatoes.
28	102°	69°	89·5	11	29·43		,,	W.	
29	105°	70°	87·5	14	29·40		,,	Calm	
30	106°	73°	89.5	15	29·44		,,	S. E.	

Nut-grass (Cyperus rotundas L.) Known in Hindustani as *Motha* is by far the most common weed on the farm in the rainy season. The plant seeds abundantly and the achenes or seed-like fruits help its very rapid spread. The plant also propagates by the rhizomes or underground stems each tuber of which contains stored food which helps to send up a new stem.

The weed may be controlled by preventing seed-formation and by cultivating infested areas to exhaust the subterranean tubers from which new stems arise.

It May be Human Nature to Gamble



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H. V. Brooks

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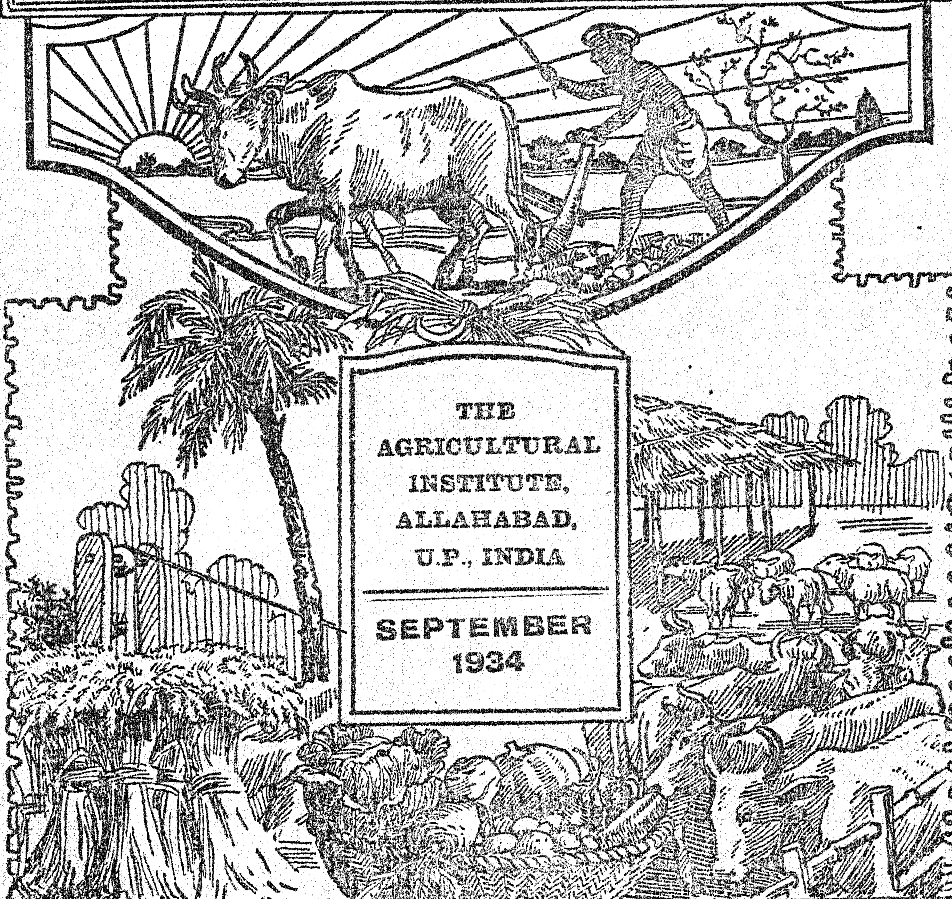
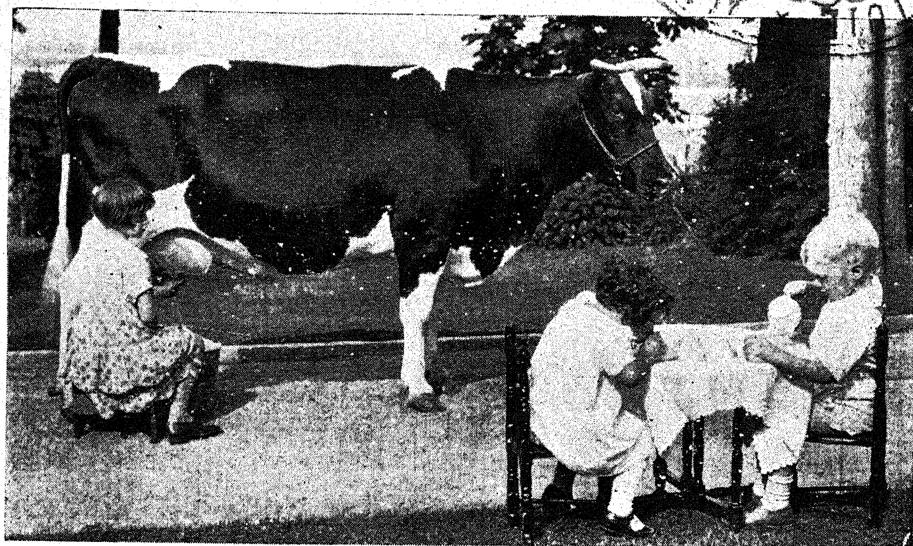


THE
AGRICULTURAL
INSTITUTE,
ALLAHABAD,
U.P., INDIA

SEPTEMBER
1934

"FOR WHAT THINGS A MAN SHALL SOW, THOSE ALSO SHALL HE REAP." GAL. VI. 7.



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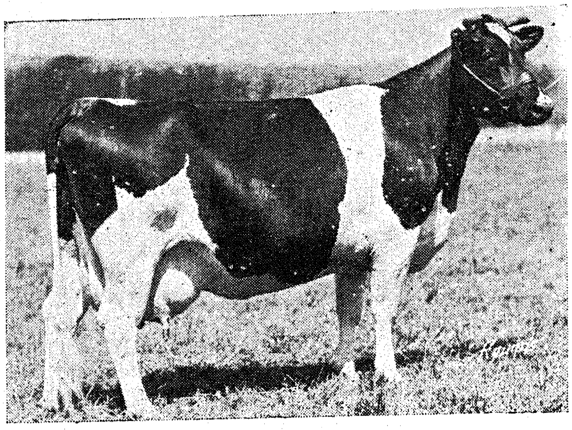

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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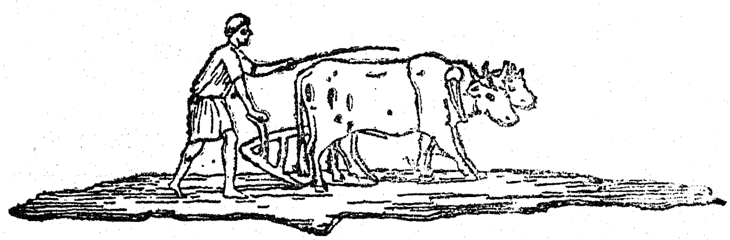
AND RURAL LIFE



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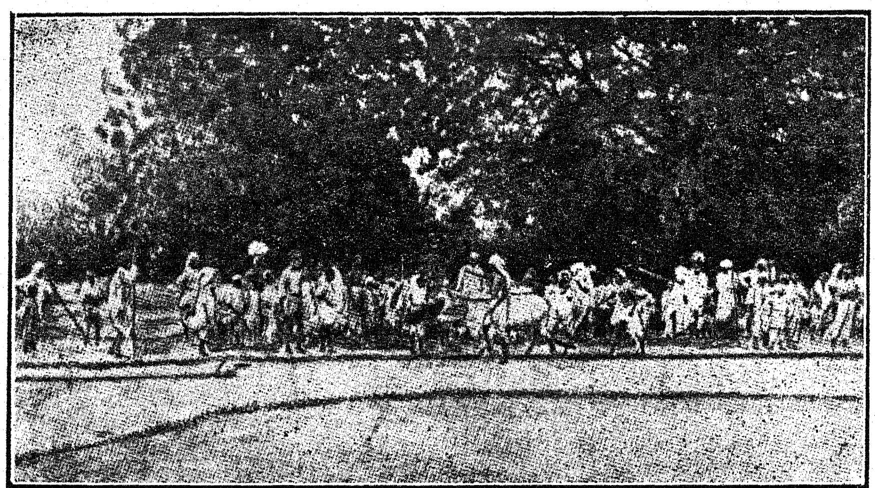
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION

SERAI AQIL

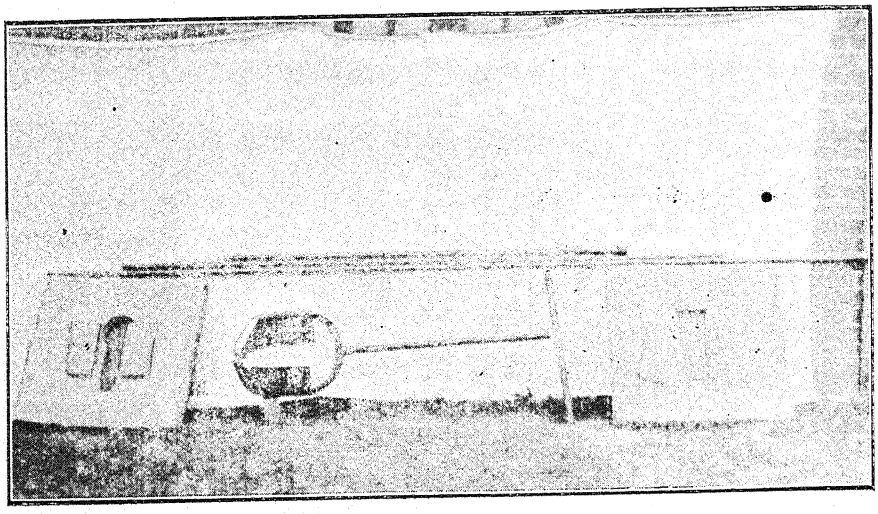
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE ALLAHABAD FARMER

VOL. VIII] SEPTEMBER, 1934 [No. 5

Editorial

Pusa Institute Transfer to near Delhi.

The Earthquake very seriously damaged the buildings at the Central Institute for Agricultural Research at Pusa. It also appeared that the levels of the land had been disturbed. Both these things seriously crippled the activities of this great Institution. There has been a good deal of complaint that Pusa was not centrally located, and more than that, that it was on the north of the Ganges and because of the time spent in ferrying across and the slow train service, a great deal of time was spent in getting to and from the estate. Again that the soils in crop schemes which could be followed at Pusa could not be followed in many parts of India and that therefore Pusa was not a suitable place for a central institute of research where work could be done of an all India value. It is therefore proposed to remove the Central Institute from Pusa to near Delhi.

We may as well recognise in the very beginning that every objection brought against Pusa, as lacking conditions suitable to all India, will have equal validity for an all India Institute near Delhi. It is also well to recognise that certain research investigations of all India importance can be undertaken at almost any place in India, provided you have the staff and equipment to do the work. This depends upon the nature of the problem to be investigated. There are other kinds of investigation which can only be undertaken in the different climatic and soil areas. What happens in one climatic area map not happen in another climatic area with similar soil, and again where you have the same climatic conditions but a different soil the results in all probability will be different.

So that what is needed is one central institution properly staffed and equipped to undertake such research as has an all India value. There should be research sections so located as to cover the different climatic and soil areas that are sufficiently

large and important to warrant having a section to study the peculiar problems of the given tract. This, of course, calls for Provincial and Imperial and Indian State co-operation, a thing most difficult to secure under present conditions in India. The real trouble arises out of differences in terms of employment. One set of workers has adjectives attached to it which workers under other contracts may not have. This causes heart-burning and opposition. But terms of contract could be so changed as to remove this difficulty.

The name "Pusa Institute" arouses a sympathetic chord in the breasts of most Americans, because it was the gift of an American gentleman, Mr. Henry Phipps of Pittsburgh, who gave the initial $150,000 to the late Lord Curzon then Viceroy to begin research, demonstration and education on a larger scale than had hitherto been undertaken in India. Considering the immensity of the task, the gift was comparatively small, and yet it was one of those international gestures of good will that has brought forth fruit a hundredfold. So Americans have always felt an interest in Pusa, and this is one reason why an American Institution in India engaged in teaching and demonstrating agriculture is interested in Pusa as well as being interested in the much broader questions of India's agricultural needs and how to meet them.

One thing that strikes the observer is that whether measured by total volume or percentages, the amounts of money spent by the Imperial and Provincal Governments of India to further the interests of agriculture are inadequate. Dr. McRae of Pusa in a debate at the Imperial Council of Agricultural Research, excusing his department, called attention to the fact that in these days of financial stringency "reductions had been drastic, the amount provided for research on crops and cattle was woefully small." The budget of the Imperial Institute set forth by Dr. McRae spent on crop work is Rs.4,83,000, on animal husbandry work, Rs.4,25,000. As far as animal husbandry is concerned there are 300,000,000 domesticated animals in India. The annual value of the animal products amounts to Rs.19,000,000,000, at prices ruling in September 1929 ; yet for an industry of such colossal proportions the Government is spending half an anna per capita of the Indian population on this department, a percentage less than any other civilised Government in the world. India is more dependent upon animals for farm power than almost any other country in the world.

As one studies the present state of agricultural research and education in India, one cannot fail to be surprised that there is no Agricultural College engaged in the teaching of better farming to students in Bengal, Bihar and Orissa and Assam. This covers some of the most densely populated areas of the world whose

population has an overwhelming majority engaged directly in farm ing. Many of the students from these areas, who wish to study agriculture, find it next to impossible to enter any of the Government Institutions because of the present deplorable attitude in Indian education of trying to make it provincial rather than national. The Allahabad Agricultural Institute is very happy indeed to have students from these three Collegeless Provinces, but hopes that the day will soon come when the Governments of these Provinces awake to their duty and provide adequate agricultural education. Most of the public bodies of India seem unaware of the fact that agriculture is the "goose that lays the golden egg" and that it is the part of wisdom to help the eggs hatch.

* * * *

The Higginbottom Association.

Elsewhere in this issue of the "Farmer" we print the constitution of the Higginbottom Association. We wish to draw the attention of the "Old Boys" to the above constitution and appeal to them to join. All letters regarding this association should be addressed to the Secretary, and all money orders and cheques should be made payable to the Treasurer, the Higginbottom Association, Agricultural Institute, Allahabad.

"There have been many empires in India. They have been made and passed. Conquerors have swept down from the hills. In the few towns clever men have traded and talked. Here and there through the centuries men have stirred the people to walk by new paths to God. But beneath all that has been in India, beneath the excitements which have so often gone over the land like a wind without trace, the enduring fabric of Indian life remains. The villager is the essential Indian. Village life in the half a million villages of the country dominates and will continue to dominate the existence of 330,000,000 Indians. Preoccupied as we have been .... with projects for Indian self-government, we must not forget that to myriads of Indians such matters as constitutional reform, Federal legislatures, Cabinet government, and the rest are only shadows of names. There must be reform from the top in India. But there must also be the reform which proceeds from the bottom upwards, and such reform must begin with the Indian village."—*The Manchester Guardian Weekly.*

RURAL BROADCASTING AT ALLAHABAD

By Mason Vaugh, B.Sc. (Ag.), A.E., *Agricultural Engineer, Agricultural Institute, Allahabad.*

For several years the needs and wants of the villager have been given a large place in the thought and plans of missionary and social service workers in India. Various schemes have been discussed and experimented with as a means of reaching the villager and of introducing to him information and training which would help his condition, morally, physically and mentally. The rural reconstruction unit, travelling exhibitions of various sorts, and other methods have been publicised and worked to varying extents.

The latest scheme to get publicity is that of broadcasting programmes of entertainment and instruction which are to be picked up simultaneously by receiving sets in a large number of villages and made audible to the people by large loud speakers. This scheme has had large publicity from various interests, both those primarily interested in improving village conditions and those interested in selling apparatus. The most widely advocated scheme has been that of comparatively small local stations serving a particular area and its local needs. Some have advocated these stations being only relays for the redistribution of programmes sent from central stations.

The Agricultural Institute (now the agricultural part of Allahabad Christian College) has long been interested in the possibilities of using radio in its work but prevailing financial stringency did not lead to hope of early activity. The situation changed about two years ago when friends in America offered to raise a special fund for the purpose of installing a transmitter here and receiving sets in surrounding villages, provided we could get a license to use it. After somewhat prolonged negotiations, Government have promised the license as soon as we are in a position to inform them exactly what equipment we will use.

The license will be at least in the first instance an "experimental" one to permit us to experiment with the use of broadcasting as a means of uplift propaganda in the villages. It will be renewable annually and subject to revocation if we violate conditions laid down or if Government should finally decide to confine broadcasting to a strictly State service. We hope at least to be able to get valuable experience and information which may be of value in using the method even though it is later State-controlled. It seems certain that there will be a broadcasting service designed especially to meet the needs of the villager. We want to study how to make such a service most effective. Information and ex-

perience we get will be available to Government or other agencies who may later take up such work.

Technically, the scheme calls for the installation of a transmitter set to work on approximately 300 meters wavelength and to deliver 100 watts to the aerial. One mast on a building and one independent mast will put the aerial approximately 100 feet high. The set is expected to have a reliable range of 40 miles under practically all conditions. Under favourable conditions, it will have a fairly reliable range for good receivers of 75 to 100 miles and under exceptionally favourable conditions may be heard much farther away. We propose to address ourselves primarily to those villages within 50 miles of Allahabad.

We also plan to provide some 25 receiving sets in as many villages. These sets will be installed, serviced and controlled by the Institute in villages which meet required standards of co-operation. They will mostly be installed in schools or other public meeting places where people will be able to congregate freely. Provision will be made for the attendance of women under conditions as favourable as possible. Simple regenerative circuits, driven by dry batteries throughout will be used. Two valves for close in locations and three for sets farther away will be tried in the first instance at least. The sets will be tuned to our station and locked there with no provision on the outside of the cabinet for tuning in other stations than our own. Operation of the set will consist of simple off and on switchiug similar to an electric light. At least for the first few sets, loud speaker, receiver, and batteries will all be housed in one compact simple cabinet, neat but with no frills to increase the cost. We expect to build the receivers and cabinets and hope to be able to install each complete for approximately Rs.150 each. Our staff will include a man to make regular visits and emergency trips when necessary.

Part of the money has been received and we hope to be able to start the installation by or before this appears in print. We expect to be able to start transmitting early in the cold whether, probably late in October. No definite date can be announced till construction has progressed further than it has yet.

No programme details have been formulated as yet but we hope to give time and attention to all phases of rural life. This will be the first station in India at least to have a complete Agricultural College as its back. In addition, we expect full co-operation from other sections of Allahabad Christian College, Allahabad University and local Government departments. Entertainment will have a large but we hope not predominating place in the programmes.

(Continued on Page 191)

BARLEY AND ITS CULTIVATION

By B. M. Pugh, B. Sc., B. Sc., Ag. (Calif.).

India occupies third place in the world in the production of barley, Russia and the United States standing first and second respectively. The area devoted to barley in India is not so extensive as that of wheat, the acreage under barley being about 7 million acres while that under wheat is about 31 million acres. United Provinces is the greatest barley producing province in India, more than half of the total acreage in India being in United Provinces. Then follows the Punjab, Bihar and Orissa, N.-W.F. Province, Bengal, Bombay, Delhi, Central Provinces and Madras.

History.—Barley is one of the most ancient of the cultivated plants. It was known in China previous to 2,000 B.C. The Sanskrit name Yava also indicates that it was known in India in very early times. However it is believed to have originated in Western Asia, in the regions between the Red Sea and Caucasus mountains and the Caspian Sea, where Hordeum spontaneum, the probable ancestor of barley is now known to be growing wild. There are at least two opinions regarding the origin of cultivated barleys. One view holds that Hordeum spontaneum which is closely related to two-rowed barley is the prototype of all our cultural forms. Another view holds that the six-rowed form is the predecessor of all our barleys. The latter view is usually more acceptable.

Barleys are usually *classified* as follows :—

(1) Hordeum spontaneum or two-row wild barley.

(2) Hordeum vulgare or six-row barley. This is the common barley and is probably the only one grown in India at the end of the last century. In this barley all the three spikelets at each node are fertile.

(2) Hordeum intermedium. This is also a six-row barley, but the grain of the middle spikelet is larger than those of the lateral ones.

(4) Hordeum distichon. This is a two-row barley. In this only the middle spikelets are fertile and the latter ones do not develop.

Barleys again may be awned, awnless or hooded. The awns are sometimes barbed or smooth. The hooded barley, instead of having awns, have a trifurcate structure called the hood.

The Botanical Characters.—Barley has a strong resemblance to wheat and oats and other members of the grass family. But it may be distinguished from the others even in the seedling stage by the character of the ligule and auricules and habits of growth.

In the early stages, barley usually stands erect with leaves usually curled on themselves, while oats may be erect or semi-erect and wheat is semi-erect. The ligule of barley is blunt, while that of oats has a number of small teeth but that of wheat is more or less blunt. Barley has also well-developed auricles but glabrous, while those of wheat are small and hairy, but oats has none. The rachis of the inflorescence in barley is also strongly compressed, and is more or less straight, while the rachis in wheat is zigzag or bent. Barleys again are usually hulled; that is the palet and the lemma are firmly attached to the kernel, while in wheat they are not. There is however a hull-less or naked barley in which the scales come loose from the kernel. Thus the kernel of hull-less barley resembles that of wheat. It is however pointed at both ends.

Ecological Factors.—Barley can be grown as far north as the 65° latitude, but it also does well in the tropical plains of the Ganges. The early varieties of barley head out in about 60 to 75 days while the late varieties take more than 75 days. The maturing of the grain of course depends on the weather conditions. In general barley matures in 100 to 110 days after seeding. Barley is more adapted to alkaline soils than other cereals. It also stands between oats and wheat in its water requirement. (Wheat—513, Barley—534, Oats—597, Briggs and Shanty). The optinum germinating temperature of barley is given by Haberland as 68°F., the minimum 38°F. and the maximum 82° to 86°F. Barley can stand a little harder conditions and also wet conditions better than wheat. While it can grow in poor soils it can also grow in rich soils. It does best on well-drained loam soils. Heavy undrained clays are not suitable for the growing of barley.

Culture.—The proper selection of seed is important. Where the grain is very small or imperfect the vitality is generally poor. The seed should be selected from a field that has not been attacked with smut; otherwise the seed should be treated for smut before sowing. That is, the seed should be thoroughly wetted by sprinkling formaldehyde solution (1 lb. of commercial formalin in 40 gallons of water). This is enough to wet 80 maunds of grain. The heap is then covered with damp gunny bags for about two hours. Then it is dried and sown as early as possible. Or the hot water treatment may be used. This consists in soaking the grain in warm water at temperatures varying from 68° to 86°F. for 4 to 6 hours and then placed in sacks or baskets and immersed in water at 129° for 10 minutes. This will kill the internal mycelium without injuring the seed.

Still another method used in some countries in Europe is to immerse the seed in a solution of K_2S (potassium mono-sulphide) one pound of K_2S in 13 gallons of water for 24 hours.

When barley is susceptible to an attack of stripe disease the seed is also subjected to the hot water treatment which consists in putting the seeds in cloth bags and dipping them in hot water for two hours at the temperature of 104°F., and then in water at 118°F. for 10 minutes and then dipped again for about a minute in a bath at 104°F. and left for two hours in a warm room. (Stripe disease is due to Helminthosporium sativum).

Barley is sown in October or November and harvested in March or April. It is sown either alone or more usually with gram when the combination is generally called "berra" in the United Provinces, or it may be sown mixed with peas, linseed, mustard and some other crops. Barley does not require a finely-pulverized bed as wheat does, so the number of ploughings is less than that of wheat. The seed-rate is about 50 seers to the acre. The best method of sowing is in drills 6 or 8 inches apart. This method makes for a good distribution of seed and the grain is placed at the proper depth of about 2 to 3 inches. Broadcasting however is the method usually resorted to by the cultivators.

Barley as a rule does not require weeding or cultivation of any kind, nor does it require any irrigation except in arid regions, in which case it is irrigated once or twice, the irrigation being generally lighter than in the case of wheat.

The cost of production is about Rs. 20 per acre ; and the average yield per acre is from 14 to 18 maunds. The approximate market price generally varies from Rs. 2 to Rs. 2-8 per maund.

Several barley types have been isolated at Pusa. The types usually recommended for United Provinces are Pusa No. 12, No. 20 and No. 21. The last is the best yielder under United Provinces conditions. Its root system is vigorous, its seed is white but with a purplish tinge. The leaves are long and broad and tillers profusely.

The yield of this type in one of the Government farms in United Provinces has been reported to be 33½ maunds, while the average yield of the local barleys is only 14 to 18 maunds per acre.

(*Continued from page 177*)

Two forms of this grasshopper are generally met with, the Short Winged and the Long Winged Rice Grasshopper.

Control.—Not much can be achieved in the way of controlling insects without the proper co-operation amongst all the cultivators in the same area. But if the cultivators in the same area are taught to be considerate and agree upon certain control measures, two things can be done to keep the number of these hoppers down. The first thing is to destroy them in the egg stage by deep ploughing in the month of March-April and the second thing is to catch the mymphs in hand nets and destroy as many of them as possible.

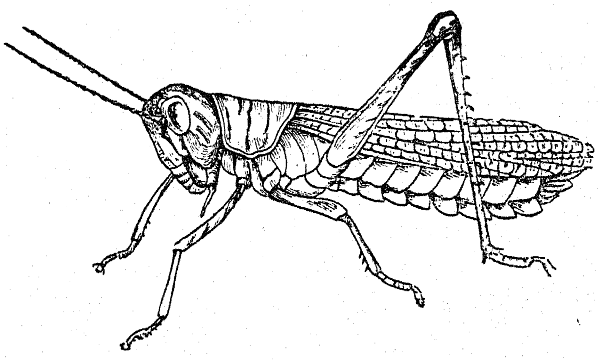
THE RICE GRASSHOPPER

VERNACULAR "BONT"

(Hieroglyphus banian)

BY W. K. WESLEY, M.Sc., L.T.

The young as well as the mature grasshoppers are ordinarily a pest of paddy, eating up the leaves and the mature forms as well as the grains out of the soft growing ears but in the United Provinces they feed on sugarcane leaves, especially in the younger stages of growth of the plant. They also feed on other grasses and small millets.



It is a beautiful bluish-green grasshopper about 1·5″ in length from the tip of the head (vertex) to the tip of the abdomen. The female grasshopper lays about fifty eggs on the average in the sugarcane or other grass fields in the months of October and November. These eggs are laid in nicely designed clusters in the soil at a depth of about one inch and each egg is a yellowish looking body, cylindrical in form, slightly curved, about one-half inch long and 5″ in diameter with one end rounded and the other more or less flattened, covered over by a delicate hard shell.

These eggs remain in the soil till the setting up of the monsoons and if this soil is ploughed at the proper time (March-April) and the eggs exposed to the birds, other animals that feed on these eggs and the sun, they are mostly destroyed but those eggs that escape the danger of animals and the weather, hatch out into little creatures after the first two or three showers by the end of June or the beginning of July.

These little creatures (nymphs) are very much like their parents in form and appearance except that they are very small and have no wings. They at once start feeding on the young leaves of the growing sugarcanes and other grasses and continue feeding, growing and developing wings through successive casting off of the old skin till after five moultings, they have reached the mature stage by the middle of September or October when they start mating. The females lay eggs again from October to November.

(Continued on page 176)

HIGGINBOTTOM ASSOCIATION

Constitution

Article I.—*Name.*

This Association shall be known as "The Higginbottom Association" hereinafter called the Association.

Article II.—*Object.*

The Higginbottom Association is organized in honour of Dr. Sam Higginbottom for the furtherance of his work in developing Indian Agriculture.

Article III.—*Membership.*

1. Present and past students and staff of the Allahabad Agricultural Institute shall be eligible for membership.

2. All persons who have been students of Dr. Sam Higginbottom in India, shall be eligible for membership.

3. All persons without regard to their affiliations, who are admirers of the services which Dr. Higginbottom has rendered to India shall be eligible for membership.

4. Persons paying Rs.500 in a lump sum or Rs. 50 per annum are entitled to life membership.

5. Persons giving Rs.50 or more in a lump sum within one year from the start of the organisation will be known as founders of the Association. They shall be entitled to all the rights and privileges of ordinary members.

6. Persons paying Rs. 5 per annum shall be known as ordinary members.

7. Present students of the Allahabad Agricultural Institute shall be eligible for ordinary membership only and they are not entitled to hold any office in the Association. The annual subscriptions for them shall be Rs. 2 per annum.

Article IV.—*Office-Bearers.*

1. The Association shall have the following office-bearers :

(i) President, (ii) Vice-President, (iii) Secretary, (iv) Treasurer.

2. The Association shall also appoint at the annual meeting an auditor or auditors for the year.

3. The duties of the office-bearers shall be such as the name of the office implies.

Article V.—*Executive Committee.*

1. The affairs of the Association shall be managed by the Executive Committee consisting of the office-bearers, the life members, and five elected members.

2. All the office-bearers of the Association shall be ex-officio members of the Executive Committee.

3. The office-bearers shall hold the same respective offices in the Executive Committee.

4. Life members are ex-officio members of the Executive Committee.

5. The Association shall elect 5 members from amongst themselves, of whom three shall be local residents.

Article VI.—*Meetings.*

1. The general meeting of the Association shall ordinarily be held once a year at a time and place designated by the Executive Committee.

2. Election of office-bearers and members of the Executive Committee shall take place at the annual meeting.

3. At all general meetings 15 members shall form a quorum.

4. The Executive Committee shall ordinarily meet once a month.

5. At all meetings of the Executive Committee five members shall form a quorum.

6. No quorum shall be necessary at any meeting adjourned for want of a quorum.

Article VII.—*Amendments.*

The constitution may be amended by a two-thirds vote in a general meeting of the Association provided the proposed amendment is presented before the Association at its previous annual meeting and a written copy is submitted to all the members by the secretary 30 days before the annual meeting.

EDUCATIONAL MUSEUMS AT THE EDUCATIONAL CENTRES OF INDIA

By J. C. Basak (1933).

This little seventy page booklet is a comprehensive outline of possibilities for educational museums in India. It will furnish many practical ideas for village school teachers wishing to improve their teaching by using visual instruction methods as well as serve as a basis for arousing interest for larger museums in or near educational institutes.

A. T. M.

A PLEA FOR COW TESTING SOCIETIES FOR THE IMPROVEMENT OF CATLLE BREEDING

BY A. N. SANYAL, INSPECTOR, CO-OPERATIVE SOCIETIES, ETAWAH, U.P.

It is well known that huge sums are being spent and very serious efforts are being made in the province for the improvement of breeds of cattle but so far there is little visible sign of improvement. *The defect lies in the system of cattle improvement that has been adopted.* As the system stands stud bulls are issued, either free of any charge or by payment of cost to the Government Cattle Breeding farms by the Public who apply for it. As the demand is very great, the Government Cattle Breeding farms have to buy bulls for stud purposes in the open market. So far as I have been able to understand from the talks with the Cattle Breeding Inspectors, no records are kept about the performances of the sires and dams of those bulls nor are they tested for tuberculosis or abortion ; and no one can be sure about the fruitfulness of the bulls. In the case of bulls purchased in the open market, these facts are still sadly lacking. So, as the system of Cattle Breeding stands, it is more or less a promiscuous breeding system which cannot be expected to give better results.

What is to be done.—There is no larger opportunity for the improvement of the Dairy Industry of our country than through the common herd. I mean by the common herd the great number of common cows and buffaloes throughout the country. We must improve the common herd so that it will be a profitable producer and not go on year after year at a standstill or, rather, deteriorate. It is through the improvement of the common herd that we can look for the largest degree of improvement in our dairy industry. It is through cow testing associations or societies combined with cattle breeding work that the improvement can be achieved along the line of least resistance and at the smallest cost either to the public or to the Government.

What is a Cow Testing Association.—While I was travelling in Denmark, I visited the Ladelung School of Agriculture in Jutland near Askov and while discussing the system of education for agriculture, I came to know about the testing of cows for milk production. I questioned our kind interviewer and I got from him all I could about the system of cow testing and took down necessary though meagre notes. Unfortunately I could not get any literature on the subject in English. On my return to England, I visited a few dairies and cow testing associations in that country and got more information about cow testing associations and could get some literature on the subject. The work of the cow testing association can be described in the following words ; a number of

farmers within a convenient radius group themselves together and form an association. The association employs a man to do the testing of milk and to keep the records. He visits every farmer in the association once a month and stays with him for 24 hours and does his work. His work is to weigh the milk of each cow at both milkings and to take a sample of each cows' milk at each milking for testing. He follows round with the farmer when he is feeding and gets a good close estimate of how much feed each cow is getting and what kind of feed. The next morning after the milking, he takes his composite sample of the night and morning milk and makes a butter-fat test and then works out the data. He multiplies the amount of milk per day that he has weighed by the number of days in the month and gets her total milk production for the month. He figures out the total butter-fat production for the month. He figures the value of the butter-fat at the market price for the production and gives the individual cow the value of her product for the month. Then he figures out the feed cost. He estimates the hay and silage and weighs the grain and figures out the cost of the feeds according to the local market, and charges the cow with what her feed has cost for the month. When he gets all the costs figured up in this way, he summarizes them and puts down the cost for the month for the herd (belonging to the farmer) and the items that are essential for the farmer to know. That is the story of the cow testing association work on the individual farm.

Purpose of the Cow Testing Association or Society.—The primary purpose of the cow testing movement was to obtain the yearly records of the yearly production of milk and butter-fat from each individual cow in the herds of the members. With these data as a basis for selection of the best producing cows for breeding purposes, to develop a strain of cows which would produce both a large quantity of milk and a high butter-fat content. Later it was found that to judge the performances of the individuals it was necessary in addition to keep account of the amount of feed consumed by each cow in order to learn which of them utilised the feed to the best advantage and soon after the work was extended to include the cost of feeding and raising calves and young stock and to thus compare the values and thus find out if Dairying is a paying proposition to the individual.

The value of milk records.—A milk record should supply the following information :—

(*a*) The total yield of milk given by the cow during a lactation period.

(*b*) The amount of butter-fat contained in the milk yielded by the cow during that period.

The keeping of milk records, in addition to enabling the dairy farmer to distinguish between superior and inferior cows, has many other advantages. Among these advantages are the following :—

1. Any slight reduction in yield will be noticed and the cause investigated at once. For instance, when a cow is unwell, her milk yield generally diminishes ; milk records therefore may often be the means of detecting an ailing cow.

2. Feeding for milk production may be carried out more economically. Since the market price of feeds and milk-producing value of foods are not necessarily directly proportionate, it is quite possible to feed a cow expensively and not produce any better results than could be obtained from cheaper foods and this uneconomical feeding can be detected.

3. Where milk records are kept, the influence of any changes of feed and the effect of climatic conditions can be noted.

4. Milk records supply data which enable the breeding, selection and feeding of cows to be conducted in an intelligent manner and they thus materially assist in placing dairy farming on a sound business footing.

5. Milk producing qualities are largely hereditary and the progeny of a heavy milking cow very often inherits the characteristics of the dam. It is therefore of first importance that the dairy farmer should have a record of the performance of his cows and should select the heavy milkers of good constitution to breed from his own herd.

The value of the sire.—It is generally conceded that the proven sire is half the herd. By this statement is meant that the better the sire the better the progeny. Dairy qualities are also transmitted through the bull used and it is important to be able to know with certainty that he is descended from a heavy milking strain and is able to transmit this characteristic.

Statistics.—Cow-testing is now a recognised way of ascertaining the milking qualities of a cow as well as of shaping cattle breeding improvements. The movement is now very popular and is spreading rapidly. Denmark was the pioneer country and the first cow testing association was organised there in 1895. The following countries have now adopted cow testing and it is being adopted very rapidly in others also. The names of the countries are Denmark, Netherlands, Germany, Sweden, Norway, Finland, Scotland, U.S.A., New Zealand, France, Ireland, England and Wales, Australia, Belgium, Czechoslovakia, Switzerland, Japan, Italy, Union of South Africa, Latavia and China. From the above list it is quite clear that every progressive country realises the value of cow testing and their Governments are not only encouraging but giving active help to start such societies.

Will Cow-Testing pay in India?—It is a fact that Indians subsist mainly on a vegetable diet (even the Mohammedans eat much less meat than what is consumed in other countries) and milk products are in constant demand. In fact, it is a complaint that the infants in India do not get sufficient milk for their growth. I need not enlarge on the importance of milk in the diet. It is too well known to need repetition. The results of various experiments on food have shown that the more virile peoples of the earth have made use of animals as providers of food particularly of such foods as milk and milk products. The health and longevity of the race, the back-bone of the nation, depends upon its milk consuming habits. In face of these facts the importance of milk and milk products can not be denied or overestimated. Now, coming to actual production by milch animals in India, we find that the range of milk productions for cows is from 2 seers per day by a Bengal cow to 10 seers per day by the Harriana breed of the Punjab and in the case of buffaloes it ranges from 3 seers to 12 seers at the most though the butter-fat percentage is higher than that of cow's milk. If it be possible to increase the milk producing capacity of cows and buffaloes producing the smallest quantity of milk even by one seer, the increase would be enormous. The farmer, by judicious selection of the milch cattle, would be able to produce the same quantity of milk with a lesser number of animals. There would be a saving of feed as well. If the work of cow testing is considered from all aspects, its adoption would be beneficial to the country as a whole. But a warning must be sounded that a miracle should not be expected. It is the continuous testing that pays and that should be carried on when adopted.

Where to start such Societies and what work to begin with.—At present all the work of cow testing associations cannot be taken up at the beginning. The first thing that can be taken up is *Milk Recording*, i.e., simply weighing the full milk yield of a milch cattle for one day (both morning and evening milkings) once a week throughout the lactation and recording it in a record book and take notes about the quantity of feed given to them. Records of breeding operations would also be kept with the history card of the milch cattle in which all the facts of the cow or she-buffalo such as date of freshing, date of calving, kind of calf given birth to, etc., would be recorded. The locality to be selected for starting such societies should be for the present the cattle breeding tracts or where the people follow *ghee making*, etc., as a profession. With this end in view my intentions are to begin with the Ghee Societies under the Parna Central Co-operative Bank, Ltd., in Tahsil Bah, District Agra. In these societies, the people are already initiated to the work of societies. But I would strongly recommend extensive propaganda before the work of milk recording coupled

with cattle breeding is taken up. The final stages of the cow testing society such as testing the percentage of butter-fat, prescribing of feeds, etc., can or should only be taken up after a number of years after the people have become fully initiated to the preliminary stages.

Sources of finance.—At the initial stage, rendering of financial help is of utmost importance. In England and Ireland the Government gives grants as premium for the bulls purchased by the Society for breeding purposes and if the conditions imposed by the Government are fulfilled, it is continued for a number of years. In addition, the services of the experts are available to go around from farm to farm and give advice to the farmers. In other countries too, even in the United States and Denmark, the Government pays some of the initial expenses but invariably gives the services of Dairy experts free and bears all the expenses of propaganda. For the rest the farmers are left to themselves and manage their own affairs. But in India, especially in these provinces, the Government will have to play a greater part and will have to meet probably the whole financial obligations at the first stage. In order to teach the farmers the lessons of self-reliance and learn to manage their own affairs, its working may be or should be entrusted to the Co-operative Department and it should interfere in the internal affairs of the society to the least extent.

How to dispose of the surplus products.—The question is "Would there be any surplus ?" The idea is absurd. The milk products are not even enough for the needs of the people. There is enough demand for pure ghee and butter but very little of the pure thing is found in the markets.

The question of surplus milk might become a problem in the villages. As I have already indicated, the suplus milk can be manufactured into ghee. For this I advocate the cream separator which would make the separated milk available for the feeding of the calves and the cream made into butter or ghee. As a later development of the cow testing societies, a cream separator may also be included. I would like to keep the manufacture of ghee as a cottage industry and I would not advocate the establishment of huge creamaries like that of Ireland and Denmark. Each village should be autonomous and should have its own cream separator—only separating the cream and handing them over to the members who would manufacture their own ghee.

The question of disposing of ghee and the surplus milk is a marketing problem and should be investigated separately.

(To be Continued.)

A SCHOOL WITH A MESSAGE

At Umedpore, in the district of Moradabad (U.P.), there is an agricultural school which is run under the auspices of the S.P.G. Mission and under the guidance and leadership of Mr. Hari Datta, one of the old boys of the Allahabad Agricultural Institute. We regard this school as one which is doing its little bit for the upbuilding of humanity in this great country of India. Far away from the surging mass of humanity and amidst one of the most depressed classes of India, it is struggling against great odds to carry light and truth into their hearts and we have no doubt at all that their efforts have met with a great measure of success.

The school with an area of about 30 acres for building, fields and orchards, has 60 boys, most of them from the Chamar class, whose ages run somewhere from 6 to 19 years of age. The boys from 6 to 12 years of age attend the nursery school while the older boys are in the agricultural vocational school. As most of these children come from the cultivators' class, many of them after leaving school go back to farming and cultivation in their own or in neighbouring villages. According to the school records, about 60 per cent. of these boys have rented land in the family in which they start their own cultivation while the other 20 per cent. rent land on which they farm. Of the children who come to the school it has been found that 60 per cent. are permanent tenants, 20 per cent. orphans and 20 per cent. non-holders of land but they can get land, if they require, on rent. These trained farmers when they leave school have been found to grow crop which are better than those of the village farmers and naturally they earn more than the other farmers, which just shows the value of a right kind of education, for social betterment and a useful citizenship.

While at school these boys are given free training and there are about 80 per cent. who earn their cost of training and of course more after leaving the school.

There can be no doubt at all to any one who visits the community in which this school is situated that its influence on the community especially as an example of good farming. is visible on all sides. The neighbouring villagers come to the school to get the best seed, better implements and also instructions in better farming, besides going around the farm itself to see the effects of imroved methods of agriculture.

Of the several boys who had gone through this school, two have also had teachers' training and are now helping in the school itself; one boy is now in charge of a garden at Government Mental Hospital at Bombay; one is teaching gardening and is in charge of a garden at Jhansi; one is in charge of a farm at Moradabad;

one is a gardener at Moradabad. Surely the school ought to be proud that her sons are all over India and making use of the training which she had imparted to them.

The staff of the school at present consists of one principal, one house father, one *patwari*, and 2 trained teachers. The total expenses of the school, including salaries, food and clothing for 60 boys and miscellaneous charges is about Rs. 700 per month. So that it costs about Rs. 100 per pupil per annum. However, much of this the boys can actually earn on the farm. For the first three years the pupils, of course, earn nothing practically ; but after that, they are able to earn about 60 per cent. of the actual cost.

The boys are brought up in an atmosphere of a purely practical farmer, that is to say they do all the farm and garden work themselves, cook their own food, wash their own clothes, etc. Twenty-six of the bigger boys are in the big school and 38 in the nursery school, of which Miss Cruddus is in charge. Boys under 12 years of age stay in the nursery school and when they reach the age of 12 they are admitted to the big school where they learn gardening and farm work. While they are in the nursery school, they have little plots where they learn to grow some vegetables and flowers, but when they come to the big school, they learn all kinds of farm and garden work such as ploughing, harrowing, laddering, sowing, irrigation, drainage, fruit, flower and vegetable growing, etc. All the boys belong to the Cubs or Scouts Association. Since the whole work is done by the boys they get very little time for Scouting. They, however, get only one hour on Saturdays in a week. The boys are divided in four groups, each group is in charge of one branch of the Farm, *i.e.*, Cattle, Farm, Garden and the fourth group does the cooking for all the boys. These groups change every day.

The boys spend seven hours on the farm and garden and 3 hours on class work where they learn Bible, Mathematics, Urdu, Geography, land survey, reading and writing of Khata Khewat and Khatauni, etc. Twice a week they get notes on agriculture and gardening.

On Sundays the boys attend morning and evening services in the Church. Outside labour is engaged to look after the grazing and watering of the farm cattle. Once a month the old boys come in from as far as twenty-five miles. They confer with the staff and get mental and spiritual refreshment. The school is recognized by Government who gives it a grant of Rs. 600 a year.

FRUIT PRESERVES

By A. D. Chand.

Guava Preserve.

Guava	... 2 lbs.	Lime	... 2 oz.
Sugar	... 3 lbs.	Salt	... 2 oz.

The difficulty of most of the immature makers has been to find out the exact stage of guavas, which will produce a good and desirable preserve. So it is a matter of great importance, for those, who are interested in manufacturing preserve, to note that unmatured hard, green guavas will yield very tough product, while the ripe and over-ripe will be mashed up during the cooking process and will therefore produce a messy sort of jam rather than a preserve. So in order to obtain good results the readers are instructed to use half-matured guavas, *i.e.*, those which are still green but are just turning tender.

Process.—Wash the guavas ; peel off the skin and cut them into small parallelopipeds. Make incisions on each piece with a pointed fork and immerse them under a lime solution for 24 hours, then drain off the lime solution and wash the fruit with clean fresh water a couple of times. Now have boiling water ready, transfer the slices into it and allow them to boil until the slices become soft and tender. Remove the container from the fire and pour the content slowly and carefully in a sieve for draining off the water, without mashing the slices.

Prepare a thin syrup using 3 pounds of sugar and 4 pounds of water, pour it over the fruit and allow it to simmer on a very slow fire. When the syrup is thickened ; remove it from the fire, and bottle while still hot.

For ordinary practical purposes the usual average temperatures of animals are given as follows :

Horses ...	... 100.5° F.	Dogs ...	... 101.0
Cattle ...	... 1 2.0	Cats ...	... 100.4
Goats ...	... 104.0	Rabbits	... 100.8
Sheep ...	... 104.0	Fowls ...	... 106.9
Pigs ...	... 103.5	Elephants	... 97.6
		Camels...	... 99.5

Generally speaking it is only when there is an elevation of 2 degrees or more above normal that an animal should be considered ill.

A hen requires half a pound of feed to produce a 2 oz. egg.

THE FOOD VALUE OF ICE CREAM

By James A. Tobey, Dr. P. H.

Author of "Milk, The Indispensable Food."

The inventor of that luscious product, Camembert cheese, was honoured in 1928 by an imposing statue, erected in grateful memory by the gustative people of France, and dedicated to the rugged farmers of Normandy. This Epicurean shrine at Camembert might well be duplicated in our own country (U.S.A.) by a monument to the man who invented ice cream. The obscure American who performed that service to humanity was unquestionably as great a public benefactor as was Marie Harel, the celebrated French peasant who prepared the first Camembert cheese in 1761.

Ice cream has been aptly characterized as a product that "makes every meal a banquet of health". This esculent food has also been called "health in frozen form," and an eminent authority on nutrition has stated that "there is no more attractive way of serving milk to your family than in good ice cream". Quotations such as these regarding ice cream could be multiplied many times, as all experts on dietetics are agreed that ice cream is one of our best protective foods.

Although pure milk is now universally recognized as our most nearly perfect food and is eagerly consumed for its unsurpassed nutritional qualities, other valuable dairy products such as cheese and ice cream are often considered merely as relishes, condiments, or desserts. Both of the lacteal products mentioned are, however, as nourishing as they are palatable, and as deserving of an honourable place in the category of nutriments as is milk itself.

As the direct descendant of milk, ice cream not only possesses most of the same unique dietary virtues, but it exhibits some in its own right. The food value of ice cream is, in fact, apparent when we consider the fact that its chief ingredients are cream, milk, and sugar, with such pleasing supplements as fruits, nuts, vanilla, chocolate, cocoa, maple syrup, and eggs which contribute to its nutritional value as well as to the flavour. Ice cream may also contain about half of one per cent. of gelatine or other appropriate substances to improve its texture.

The exact composition of ice cream varies, of course, according to its constituents, but an average ice cream will have about 12 per cent. butter-fat, from 9 to 11 per cent. milk solids not fat, and 14 or 15 per cent. sugar. Whole milk averages about 13 per cent. total solids of which a little less than one-quarter, on about 3.7 per cent. of the milk, is butter-fat. It is obvious, therefore, that ice cream is a richer and better source of certain desirable food elements.

When measured by the standard heat or energy units known as calories ice cream deserves its picturesque descripton as "frozen heat." An average serving of vanilla ice cream, consisting of one-sixth of a quart, will yield 193 calories as compared with about 170 from a glass or cup of whole milk. A quart of ice cream averages about 1,200 calorics, although the yield will vary according to the composition and in some cases may be lower. A quart of milk provides 680 calories, or about one-quarter of those needed in an individual's daily diet.

As a fuel food, ice cream is an excellent source of readily available energy. The human machine needs more than fuel, however, requiring such other essential factors as proteins, minerals, and vitamins, dietary substances which replace tissues, build bones, promote growth, and otherwise assist in various bodily processes. In all these respects ice cream fulfils the specifications of a well-rounded food.

Ice cream resembles milk in that it is a good food for energy but is more than a mere source of fuel. Because of its added sugar, it is superior to milk as an energy food and it also often contains a slightly higher proportion of certain minerals, particularly lime salts, or calcium phosphates, which are necessary to the construction of strong bones and sound teeth.

Since milk is recognized as the best dietary source of calcium and phosphorus, all progressive physicians and nutritional authorites are agreed that every growing child, every expectant and nursing mother, and all undernourished persons should have at least a quart of milk a day in some form, because this desirable quantity of milk insures an adequate daily intake of the necessary calcium. A quart of milk furnishes about one gram of this mineral, or approximately one-thirtieth of an ounce.

The abundance of calcium in ice cream makes it a suitable replacement for some of the milk as a daily source of calcium, or better still, ice cream may be employed as a valuable supplement to milk for this purpose. Careful experiments on human subjects, conducted at the Kansas Agricutural Experiment Station several years ago, have shown that the calcium in commercial ice cream is as well utilized as the calcium from raw milk, and that the utilization of phosphorus showed a similar result. This study also brought out the fact that ice cream, like milk, is an alkaline food and thus is beneficial in maintaining the so-called acid base balance of the body.

Other desirable minerals, such as iron, are also present in ice cream. As in the case of milk, the iron is not abundant, but the amount available is exceptionally well utilized by the body, especially when every small quantities of copper are like-wise present, as they are in all pasteurized ice creams. The addition of certain sub-

stances to the ice cream mix, such as fruits, nuts, and chocolate, not only enhance its flavour and taste, but add iron and other minerals. Nuts contribute protein as well as minerals, while fruits augment the vitamins already present.

As a source of vitamins, ice cream resembles its ancestor, milk, in that it contains all of these known accessory food factors and is especially rich in the growth-promoting vitamins A and G, vitamins which also perform other desirable functions in the body. Since a liberal supply of vitamins is necessary to good health and vigour, ice cream is valuable for this reason alone. Experiments have demonstrated that vitamin D, the antirachitic factor, can be increased in ice cream by irradiation and that freezing does not alter the properties of this important vitamin, which causes proper deposition of the lime salts in the bones. Many irradiated pasteurized vitamin D milks are now on the market, and vitamin D ice creams may eventually be as popular with consumers.

Scientists have investigated the nutritive properties of ice cream by means of tests with laboratory animals and have demonstrated that this product is a true protective food. At the University of Minnesota, for example, Prof. L. S. Palmer showed that white rats fed on ice cream as the sole diet gained in weight more rapidly and developed more satisfactory than rats fed partially on ice cream, or those whose diets were lacking in this product. Similar favourable results on an ice cream diet were obtained by Prof. A. W. Homberger at the University of Louisville.

These laboratory investigations have been confirmed by experiences with children and adults. Thus a specialist on child care, Dr. Samuel Adams Cohen, has reported excellent results in feeding malnourished children on ice cream, with consequent gains in weight, and no digestive disturbances or other ill effects. Numerous other physicians have reported similar favourable experiences. Ice cream is also frequently prescribed in the diets of patients suffering from febrile diseases such as typhoid fever, and it is a favourite and appropriate part of the dietary regimens in all hospitals.

In an able discussion of the problem of sweets for children Prof. Henry C. Sherman of Columbia University writes that, "A liberal amount of ice cream may be good—they may like it because of its sweetness and they will almost certainly be benefited by the extra milk and cream which they thus get." Prof. E. V. McCollum has written that, "The more frequent serving of ice cream at the family table is one of the easiest ways of getting milk into the diet, especially for children who do not like milk and for persons who demand food with marked flavours."

Despite the acknowledged food value of food ice cream, the

people of the United States do not consume enough of this nutritious product. For that matter they do not use the quantity of milk and dairy products that would be most conducive to an improvement in national health. In 1932 somewhat over 154,000,000 gallons of commercial ice cream were manufactured in this country (U.S.A.), and probably almost as much was made in the home.

The per capita comsumption of ice cream is, nevertheless, too low, amounting in 1931 to only 2.42 gallons per person, according to the estimates of the United States Department of Agriculture. As in the case of milk, the consumption of ice cream has been decreasing since 1930 and to-day it is lower than a year ago. If the merits of ice cream as a food could be brought to the attention of all persons, a material increase in its use might result.

An adequate annual diet at a moderate cost should include 305 quarts of milk or its equivalent, according to officials of the United States Department of Agriculture. Such an allowance would be approximately double the amount of milk now consumed in this country. Ice cream, health in frozen form, is virtually the equivalent of milk as a desirable component of the well-balanced diet, and it deserves an ever-increasing popularity in our nutritional scheme.

(Continued from page 173)

For this, music will be an important feature but a place will be given to story telling, drama and other forms of entertainment.

Realising our lack of experience and knowing that many others are also interested in the success of this experiment, we will welcome suggestions, draft programmes, material which you think suitable for broadcast either as it is or after adaptation, stories, dramas, music, or anything which you may have to offer to promote ths success of the scheme. Particularly, we would welcome material which our readers have used successfully in meetings or programmes. As full details as possible including some clue to tunes for songs sent, stage directions for dramas, and any other hints that you think helpful. We would like permission to adapt anything sent if we think it necessary ; we promise to treat your material and ideas with respect, even if we cannot use them. We hope that our readers and friends, even though they be outside the area we can reach, will help us freely. Your co-operation may bring the time nearer when such a service will reach your locality. Communications on this subject may be addressed to "Radio Committee", Agricultural Institute, Allahabad.

KEEPING MILK GOATS IN INDIA

By J. L. Goheen

Chapter II

Breeding

Under this subject of Breeding the chief word that needs to be kept in mind is—Selection. To know how and what to select is a matter that requires study and some practical experience. For instance, Vitality, or Good Health, is an outstanding requirement for good milk goats. A weak sickly animal cannot produce either much milk or strong healthy progeny. As a rule goats are healthy animals but some are more so than others, and weak run-down goats should never be chosen for breeding purposes. Only strong, healthy, vigorous and fully-matured goats should be chosen.

Next, there is a principle in breeding that "like begets like", and it also is a most important one. If one wants goats that give plenty of milk one must be careful to choose those for breeding that are descendants of good milkers. Especially is this true of the male goat for it has been discovered that the male has the property of transmitting the good qualities of his mother on to the next succeeding generation. And as a breeding male, carefully chosen for that purpose, he is able to mate many females and thus influence the succeeding generations for good through his numerous offsprings or descendants. If, in addition to having a good male for breeding, the female herself is a good milker and is descended from good milkers, the young born of such a mating would almost certainly be far better than those from a pair where the mother was not of good qualities, even though the male was a fine animal, carefully chosen for breeding. But remember, if you cannot have such a fine female, make certain to choose the male very carefully, looking thoroughly into his history in order to know from what kind of stock he himself has come.

Another fact must be kept in mind, when selecting goats for breeding, and that is, there are no two descendants that are exactly alike. This is true even of those born of the very best parentage. There are bound to be some differences. For instance, one child may be larger, another female may give more milk than her sister, one may have a quiet disposition and another one may be restless, and so on. It is most important, then, to be able to select those animals out of the lot that have the very best qualities, such as a quiet disposition, ability to produce an abundance of milk, good size, strong bones, an active temperament, and so on. Only the best should be chosen and all others rejected. Otherwise there will not be the degree of improvement one would wish to see.

This is where experience in selecting is required, and where one must learn to be very exacting in making one's choice. One will be tempted to accept that which is not so good, but one must have a mind strong enough to resist such temptation.

Now, in applying these principles to the business of improving ordinary country goats, the first step is to find a male that will be thoroughly suitable for heading up the herd as a reliable breeder. To do this it is best to try to secure a male of pure breed. In India there are several breeds that may be said to be pure, or so nearly so that their progeny practically always are born true to the qualities or characteristics of that particular breed. For instance, there is the Surti breed, which originated in or near the city of Surat, in Gujerat. There is also the Jamnapara breed which is said to have originated in the city of Lucknow, or in that general region; there is a breed in Hyderabad State sometimes called the Oosmanabad breed; and there is also the "West Coats" breed which is supposed to have originated in the Malabar region. All of these breeds are noted for their good milking qualities, and there are probably other breeds which, at present, do not seem to be quite so well known.

FISH MOTHS OR SILVER FISH

These are glistening silvery-coloured insects which dart about in books and starched clothing, or among papers in libraries. They are known scientifically as LEPISMA spp.

According to G. C. Haines, entomologist, Division of Plant Industry, South Africa, females of these insects lay about 8 to 10 eggs which may hatch from 6 to 60 days, depending on temperature. In tropical climates these insects mature in about 7 to 9 months. Their food consists mostly of starch and glue. So they are pests of book-bindings, starched clothing, etc.

These pests may be controlled by one or other of the following methods:

(1) Mix 12 parts of sodium fluoride in 100 parts of flour and sprinkle the mixture in places where they abound.

(2) Make a paste of ½ oz. of white arsenic in 1 pint of flour. Daub this paste on to pieces of card board and roll it into a cylinder and place it wherever insects are to be found. This is a poison and children should not gain access to it.

(3) In an outbreak of fish moths, sprinkling with paradichlorobenzine is claimed to quickly destroy them.

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

May 1934

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction.	Remarks.
1	107	74	90·5	15	29·46	..	1·74	S.	Levelling ploughing and manuring of fallow lands continues.
2	106	78	92·0	40	29·45	..	„	N E.	
3	104	76	90·0	23	29·36	..	„	Calm.	
4	109	79	94·0	60	29·28	..	„	E.	Early maize sown.
5	103	78	90·5	64	29·29	..	„	E.	
6	102	80	91·0	48	29·30	..	„	N.N.W	Planting seeds in vegetable nurseries.
7	108	78	93·0	29	29·34	..	„	W.S.W.	
8	109	82	95·5	12	29·40	..	„	W.	
9	109	78	93·5	15	29·42	..	„	W.N.W	Irrigation of bajra.
10	108	78	93·0	18	29·38		„	W.	
11	108	76	92·0	17	29·44	..	„	W.	
12	110	76	93·2	20	29·44	..	„	S.W.	
13	110	80	95·0	18	29·44	.	„	S.W.	
14	110	82	96·0	19	29·42	..	„	S.W.	
15	106	73	89·5	10	29·38	..	„	W.	Harvesting of bajra and Napier and Guinea grasses for fodder.
16	107	78	92·5	12	29·41	..	„	W.N.W	„
17	110	78	94·0	18	29·41	..	„	Calm.	„
18	113	79	96·0	19	29·40	..	„	N.E.	„
19	109	79	94·0	19	29·37	..	„	W.	„
20	109	80	94·5	20	29·38	..	„	W.	„
21	109	80	94·5	20	29·34	..	„	W.N.W.	„
22	112	80	96·0	19	29·33	..	„	N.N.W.	
23	110	84	97·0	12	29·33	..	„	W.S.W.	
24	110	82	96·0	18	29·30	..	„	W.	
25	112	82	97·0	17	29·33	..	„	W.	
26	114	82	98·0	13	29·26	..	„	W.	
27	113	83	98·0	20	29·27	..	„	E.	
28	112	83	97·5	40	29·28	..	„	E	
29	110	81	95·5	15	29·24	..	„	W.	
30	108	82	95·5	15	29·28	..	„	S.W.	
31	110	83	96·5	17	29·33	..	„	W.	

June 1934

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction.	Remarks.
1	114	85	99·5	37	29·40	..	1·74	N.	Harvesting of fodder grass, Napier and Guinea, continues.
2	113	86	99·5	44	29·35	..	„	E.	
3	110	87	98·5	24	29·38	..	„	N.E.	
4	110	81	95·5	30	29·42	..	„	N.	Weeding in fields of Banda.

JUNE 1934—*(contd.)*

Date.	Max. Temp	Min. Temp.	Mean Temp	Percentage of Humidity.	Atmosphere pressure.	Rain of the day.	Rain Since Jan. 1.	Wind direction.	Remarks.
5	105	81	93·0	40	29·39	.	1·74	W.	
6	106	83	94·5	36	29·35	.	,,	N.N.W.	
7	106	85	95·5	55	29·39	..	,,	W.	Levelling and fallow ploughing continues.
8	105	86	95.5	45	29·35	..	,,	E.	
9	107	88	97·5	47	29·31	.	,	E.	
10	109	85	97·5	49	29·26	..	,,	E.	
11	112	80	96·0	48	29·20	.	,,	E.S.E	
12	113	84	98·5	60	29·25	..	,,	E.	Nursery work continues.
13	110	85	97·5	55	29·24	..	,,	E.	
14	109	88	98·5	40	29·12	..	,,	E.	Irrigation of early fodder, maize, juar, etc.
15	112	87	99·5	65	29·15	.	,,	E.N.E.	
16	110	82	96·0	18	29·33	Trace	,,	E.N.E.	
17	108	81	94·0	60	29·31	..	,,	N.N.E.	
18	101	80	90·5	69	29·30	·11	1·93	W.	
19	102	76	88·0	72	29·36	·40	2·33	E.	
20	97	75	86·0	80	29·32	·09	2·42	W.	
21	96	80	88·0	68	29·26	..	,,	W.S.W.	
22	103	78	90·5	92	29·26	·03	2·45	W.	Planting juar on unirrigated fields.
23	100	78	89·0	88	29·30	·24	2·69	Calm.	
24	86	76	81·0	84	29·26	·26	2·95	E.	
25	86	76	81·0	85	29·30	·30	3·25	E.N.E.	Planting of Napier started.
26	89	74	81·5	80	29·32	·76	4·01	E.N.E.	
27	98	80	89·0	70	29·32	..	,,	E.	Transplanting tomatoes, chillies and brinjals.
28	100	80	90·0	75	29·30		,,	E.	
29	100	79	89·5	78	29·21	·14	4·15	E.	
30	101	74	87·5	98	29·22	·36	4·51	W.	
July 1934									
1	90	76	83·0	90	29·24	23	4·74	W.S.W	Preparation of seed-bed and sowing of Kharif crops begins, and continued for the whole month.
2	90	76	83·0	87	29·22	Trace	,,	N.N.W	
3	97	79	88·0	83	29·16	·06	4·80	E.	
4	99	80	89·5	80	29·16	..	,,	E.	
5	100	79	89·5	85	29·24	Trace	,,	E.	
6	100	78	89·0	70	29·26	..	,,	E.	
7	103	80	91·5	75	29·24	..	,,	Calm.	
8	100	74	87·0	95	29·22	·50	5·33	Calm.	Planting of Napier and vegetables continued.
9	100	74	87·0	90	29·20	Trace	,,	W.	
10	90	76	84·0	91	29·18	..	,,	W.	

JULY 1934—*(concld.)*

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction	Remarks.
11	92	74	83·0	86	29·12	80	6·13	W.	
12	88	78	83·0	75	29·18	·02	6·15	W.S.W.	
13	88	76	82·0	77	29·30	..	,,	W.	
14	88	75	81·5	77	29·36	Trace	,,	W.	
15	92	76	84·0	78	29·30	..	,,	S.W.	
16	92	77	84·5	72	29·36	..	,,	S.W.	Levelling up to date
17	93	79	86·0	66	29·35	..	,,	W.	
18	98	82	90·0	63	29·30	..	,,	W.	
19	100	82	91·0	56	29·26	.	,,	W.	Manuring fallow lands for Rabi crops (gram and barley).
20	100	80	90·0	84	29·25	Trace	,,	N.N.E.	
21	90	76	83·0	84	29·23	·13	6·28	N.E.	
22	100	76	88·0	95	29·22	·42	6·70	W.	
23	90	77	83·5	81	29·26	Trace	,,	W.N.W.	
24	89	76	82·5	85	29·30	Trace	,,	Calm	Weeding of Juar fields.
25	91	72	81·5	87	29·34	1·25	7·95	E.	
26	87	74	80·5	90	29·32	.	,,	W.S.W.	
27	89	72	80·5	98	29·34	1·75	9·70	S.S.W.	
28	82	72	77·0	96	·9 36	0·38	10·08	Calm.	
29	89	73	81·0	90	29·33	0·08	10·16	Calm.	
30	87	72	79·5	84	29·37	0·62	10·78	S·E.	
31	90	76	83·0	81	29·42	0·05	10·83	W.N.W.	

The value of Meteorological Records

"Every person interested in agriculture should keep detailed records of the dates of planting of various crops, whether this planting was at the proper season to produce quick germination, rapid growth, and seasonal maturing; and above all a record of the prevailing weather and its effects.

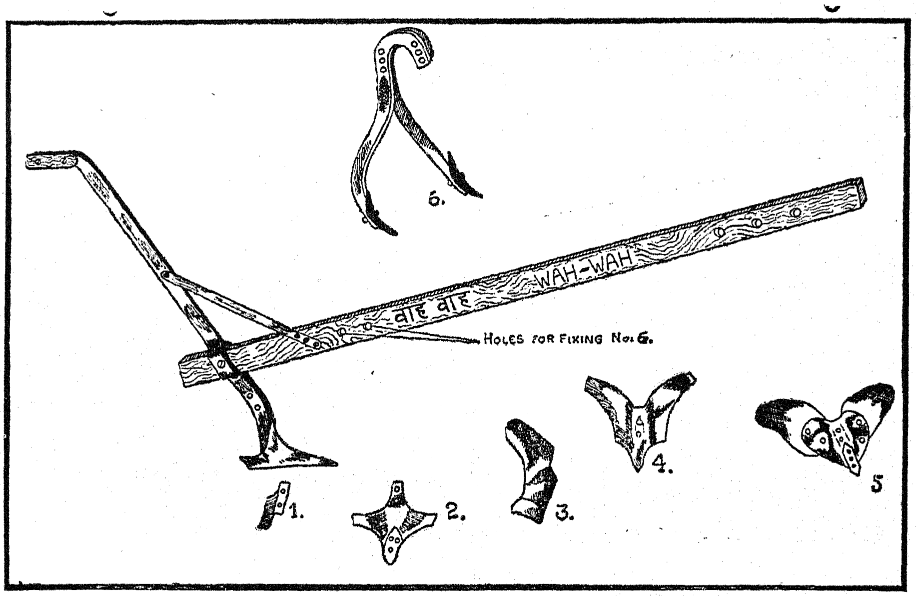
A properly located rain-gauge, and a set of maximum and minimum thermometers exposed in an inexpensive shelter, will give records of very great value in handling farm work and in studying the effect of the weather on the condition of different soils and the growth and yield of various crops. The expense is small and the time necessary for the records very little, while the results are very illuminating. But with or without instruments, a daily journal of the weather will be of untold interest and value as one year follows another with its problems and queries as to reasons for crop failure or success, insect activitives, results of spraying, and the like."

J. W. SMITH,

ALLAHABAD AGRICULTURAL INSTITUTE

CAN NOW SUPPLY

THE "WAH-WAH" PLOUGH WITH ATTACHMENTS



The "Wah-Wah" plough is suitable for all purposes. It works on the same principle as the desi plough, but is more efficient. The smallest country bullocks are sufficient to work it. Price complete, **Rs. 6-8**. Iron parts only, without wooden beam, **Rs. 5-8**.

SPARE PARTS AND ATTACHMENTS

No. 1. Stabilizer used with flat sweep and furrow makers.

No. 2. Flat sweep for replacement, with cultivator attachment. Has replaceable patch point, **Re. 1**.

No. 3. Meston Bottom modified for attachment to "Wah-Wah" Plough, **Rs. 5**.

No. 4. Furrow maker. Can be supplied in 10″, 12″, and 15″ sizes, for making all sorts of furrows and ridges. With cultivator attachment can be used for cultivating, weeding, and mulching. **Rs. 3-12, Rs. 4-12 and 6-8**, respectively.

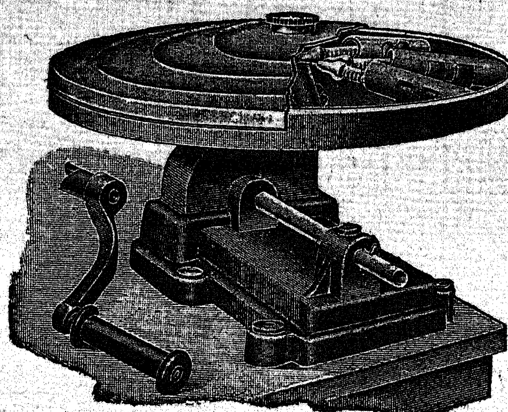
No. 5. Special furrow maker for making furrows for sugar-cane planting. Can also be used for earthing up crops, **Rs. 10-12**.

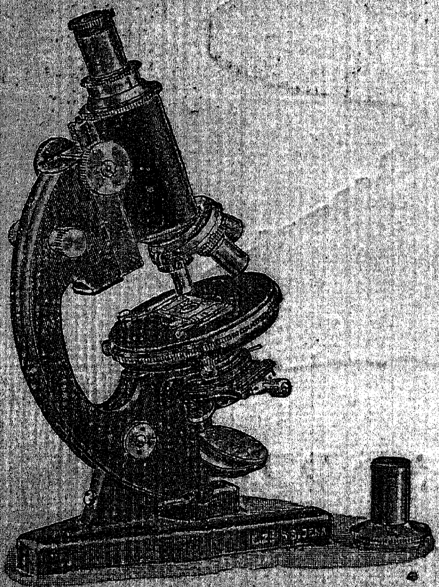
No. 6. Cultivator attachment. This is useful for interculture, **Rs. 6**

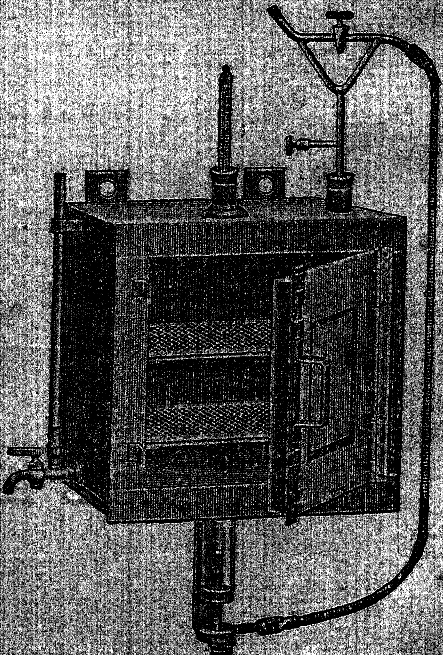
(NOTE.—Furrow makers are imported at present, and prices are subject to change.)

Prices and particulars from—

AGRICULTURAL ENGINEER







A. V. Brooks

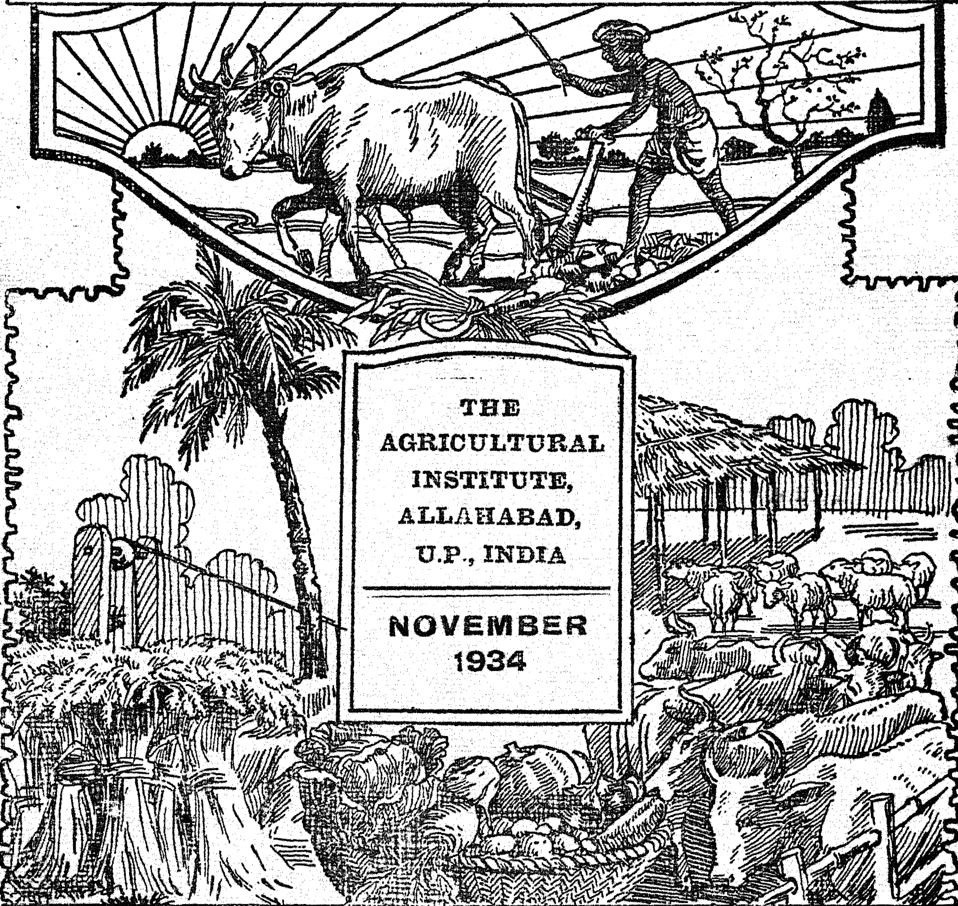
VOL. VIII] [No. 6

THE ALLAHABAD FARMER

A bimonthly Journal

OF

Agriculture and Rural Life



"THE ONLY EDUCATION THAT IS DOING INDIA ANY HARM IS THE EDUCATION IT DOES NOT GET. IT IS IGNORANCE AND NOT EDUCATION THAT IS EXPENSIVE VIEWED FROM THE NATIONAL STANDPOINT

SAM HIGGINBOTTOM.

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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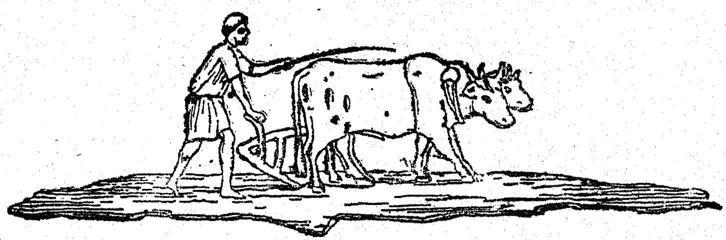

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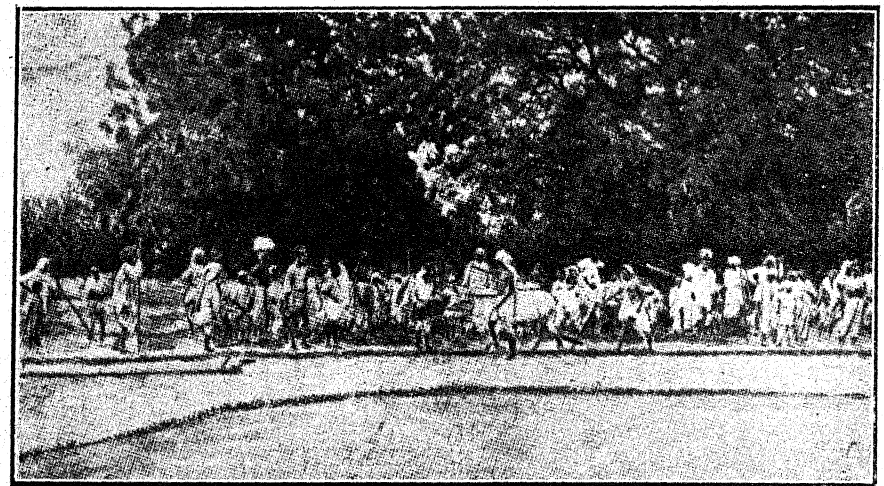


PLOUGHING DEMONSTRATION

SERAI AQIL

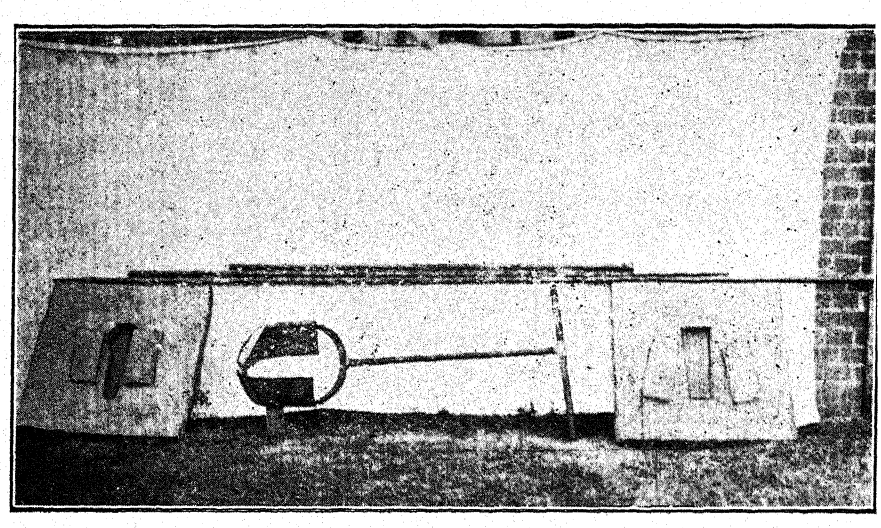
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE
ALLAHABAD FARMER

VOL. VIII] NOVEMBER, 1934 [No. 6

Editorial

The College and its Alumni.

The only education that is doing India any harm is the education it does not get. It is ignorance and not education that is expensive viewed from the national standpoint. Education whether of hand or mind multiplies the earning capacity of the one who gets it. Society is willing to pay more to the educated man than to the uneducated. So India needs more education.

But in addition to increasing the earning power of a man, education gives him a possession which no vicissitudes of fortune can take from him. The educated man has a disciplined mind and spirit which works in an orderly way. In addition he has resources within himself, if he is truly educated, which lead to enlargement of vision and enrichment of life. True education gives the possessor a cosmopolitan attitude. It breaks down bigotry and intolerance. It gives a man insight and understanding and sympathy. In every way true education enriches body, mind and spirit.

When the question of free education comes up it is usually acclaimed with great enthusiasm. But I submit there is no such thing as free education. Any worth-while education costs either the individual or the state large sums of money. When the individual cries out for more free education he is really inviting the Government to tax him more heavily in order to pay for an education which provides for all who are capable of receiving it and ask for it.

But the acquiring of an education costs society as well as the individual a large amount of money and time. The students and their parents and guardians have to pay fees for them from five to twenty years. The student has to be supported all these years. He is not an earning member of society in the economic sense. In addition to the personal expenses of getting an education, large sums of public money are devoted to this end. Government gives to the five Universities in the United Provinces many lakhs of rupees each year. Yet each University feels that it cannot provide the education demanded of it out of its income from fees and Government grants.

If education in India is to be truly democratic and within the reach of all, new sources of income must be tapped. As one looks round one realises how generous India is. No matter how poor the family in India, they always seem able to spare a little for the religious beggar and the needy that appeal to them for help. The large number of temples and mosques and churches in India show the way the people are willing to support their religions. Several Indian universities bear excellent witness to the far-sighted wisdom and generosity of Indian benefactors who have given large gifts to increase the usefulness of these universities. But as yet the ordinary educated person has not regarded the educational institutions of the country as in need of their particular help. They feel that Government should provide the funds. When the true function of education in the enrichment, not only of the individual life, but of the whole life of society is properly understood, the people of India will be as generous to the temples of learning as they are to-day to the temples of religion.

Every College and University in India should have an Old Students' Association which should have as its function, not only a pleasant social time when the "Old Boys" come together and renew their youth; and for a brief period escape from the cares and worries of a hard world; but the old boys should look deeper and see that their Alma Mater keeps pace in education to meet the demands of modern society. I do not say that every boy who received a scholarship from his College, otherwise he could not have gone to College, should feel that he must necessarily pay back his scholarship. But, many a man, who without the help of the College financially, would not have been able to pursue his education, who has found education the stepping stone to financial success, might out of gratitude, and to repay to society what it put into them, give generously of his acquired wealth to enrich the College that gave him his opportunity. In a number of institutions in India to-day there are those who are giving generous gifts for scholarships and also to help to pay teachers, to provide buildings and equipment, but not enough is being done to meet the needs of the India of the new day. Every high school and College should develop in its student body a sense of loyalty and responsibility to hand on the torch of learning, not only unimpaired, but with increased light and power. A few decades ago the financial outlook in America was very bad for institutions of higher education but most of the institutions have so developed their Old Boys' Associations that, now, they count on them to provide a large part of the income of the institution. I append some remarks from some educators in the United States, showing what they feel about these Alumni or Old Boys' Associations :—

President King of Amherst

"I regard the Alumni Fund as the most significant and most useful gift received by the College. Its direct value in supporting the policies of the College is substantial. Its indirect results are more significant. The letters of class agents, the bulletins issued by the Alumni Office, the James dinner, are external manifestations of the deepened interest and understanding of the Alumni in their Alma Mater. And this is both incentive and inspiration to us at the College as we attempt to realize more fully the ideals of Amherst."

President Angell of Yale

"I can only express to other University officials the hope that they may be able to create and maintain among their Alumni, loyal groups who will serve them with the same extraordinary fidelity that Yale has found in the officials of her Alumni Fund. They have not only through their Class Agents succeeded in bringing to the University year after year financial support of an indispensable character, but they have also done what I regard as far more significant, in that they have kept our Alumni body intelligently and sympathetically informed of the plans and the ideals of Yale. The result has been a widespread and uninterrupted moral support and for our undertakings which has always been of the greatest inspiration which has undoubtedly resulted in an intelligent loyalty to the University that could have been secured in no other way."

Presidet Hopkins of Dartmouth

". . . . It is entirely beyond my ability to express the importance which I attach to the existence of the Alumni Fund in the development of the College policies . . . . I should say that with the exception of an occasional endowment, there were no moneys contributed to College support which had the possibility of being as useful toward obtaining College objectives as is the money received from an Alumni Fund . . . . I regard the indirect value of the Alumni Fund campaign and achievement as being of great supplementary importance beyond any of the benefits which the receipts of the income makes possible. My own observation has deepened my original belief that when men contribute financially to a cause in which they are interested their solicitude for the validity of that cause becomes even more intensified than before. . . ."

President Nicholas Murray Buttler of Columbia

"Columbia University must, therefore, depend for its prosperous continuance upon thousands of relatively small gifts. A steady flow of gifts from the Alumni, moderate in amount but large in

number, must be one of the University's chief sources of dependence for its continued usefulness in the years that lie just ahead of us."

"The Ohio State University Association is a constant source of support and enthusiastic spirit for the University Faculty and Administration. As its membership increases, its activities and influences spread and it is an intelligent nucleus for wise and creative planning."—President Rightmire.

I hope that all Indian patriots will take a deeper interest in bettering the education offered to Indian youth and will support this education with generous gifts. I suggest a few ways in which help could be given :—

(*a*) Large gifts for endowment and buildings and equipment.

(*b*) Large gifts of Government and other securities for endowment.

(*c*) Annual gifts from every old boy. If the average gift were Rs. 10 per old boy per year it would be a very substantial sum.

(*d*) Pay the premium on an insurance policy in favour of the College. If each student would take out an insurance policy on his life for a thousand rupees or more in favour of the College, the College would receive this sum upon his death. After some years there would be a substantial fund built up. Princeton University has received from this source in about eighteen years over eight hundred thousand dollars for its endowment.

(*e*) Leave a sum in his Will for the College.

But it is the large number of small gifts rather than the few large gifts, that are the main stay of educational institutions. So if every old boy would send every year a small gift to his Alma Mater, and a larger gift in case he can afford it, they would be on the way to providing India with an amount and quality of education that would soon lift her to the forefront of the educated nations of the earth.

I count on the loyalty and good-will of the past and present students of the Institute to do their best to keep up its standards.

SAM HIGGINBOTTOM.

* * * *

The Higginbottom Association

In our last issue of the FARMER, we were able to publish the draft constitution of the Higginbottom Association. The first meeting of the Association took place on the 1st October, to which the former students and friends of Dr. Higginbottom were invited. The gathering was presided over by

Mr. Rama Nama Prasad, an Advocate of the Allahabad High Court and one of the old students of Dr. Higginbottom. After the passing of the constitution the office-bearers of the Association were elected. The members who have so far registered will bring a membership fee of about Rs. 500 a year. The money goes to the Institute to further its objects. It is hoped that many others especially the "Old Boys" who are sympathetic with the aims and objects of the organization will join.

The editorial committee of the Allahabad FARMER is also happy to announce that the subscription of the FARMER for the members of the Higginbottom Association is only Rs. 2 per annum.

* * * *

The Agricultural School, Chinsurah.

It is with much gratification that we learn that an Agricultural School has been started in Chinsurah, Bengal, and that a very strong Committee has been formed for the management of the school. We wish all success to the school and we hope that it will be only a stepping stone to a higher usefulness and service which only an institution of a College grade can render. It is such a great pity that up till now there is not a single Agricultural College in Bengal and Assam, while rumours are persistent that the Government Agricultural College in Burma also may be closed down. This last would be a retrograde step in this period of building up this great nation.

* * * *

Seed Distribution in India.

We have only recently received a Souvenir brochure from Pestonjee Pocha and Sons, Poona, who are well-known all over India as the distributors of vegetable and flower seeds. The House of Pocha is celebrating this year its Golden Jubilee, having reached its fiftieth year since the company was first started. We offer them our most sincere congratulations.

We believe that one of the greatest needs of India to-day is reliable seedsmen who can guarantee the purity of their seeds. But as long as there are no laws in the country to prevent seeds being sold under a name to which they have no claim at all, it will be very difficult to compete with swindlers and unprincipled seedsmen. Hence the progress of agriculture in this country will be greatly retarded. We do hope that in the next few years the Government will see their way to the creation of "pure seed laws", through which there will we some sort of a guarantee of the seeds one is going to buy.

The Reclamation of Salt and Alkaline Land.

We would like to draw the attention of our readers to the fact that the article on the subject "The Reclamation of Salt and Alkaline Lands," by Dr. McKenzie Taylor, Director, Irrigation Research, Punjab, published at page 91 of the May issue of the Allahabad FARMER, was written by that officer for the Waterlogging Board, Punjab, in the beginning of 1931. It represents a summary of work during three previous years and not the latest information acquired by Dr. McKenzie Taylor on the subject. We regret that due credit was not given to the sources of the article when it was published but we are very happy to do it now.

* * * *

Soil Erosion.

One of the reasons why the soils of any country are getting poorer is because the plant food in the soil is being continuously removed by the crops grown on those soils. The amount of plant food removed is considerable. Yet it has been estimated by some one that the amount of plant food removed by the actual removal of the soil by rain wash and by winds is even greater. It has been estimated that the river Ganges alone carries in a year 355,361,000 tons of solid matter to the sea. Cook calculated that "if a fleet of 973 ships, each laden with 1,000 tons of mud, were daily to sail down the Ganges to the sea, this fleet of vessels would just perform the average daily work performed by the waters of the Ganges." Anybody who has travelled over that part of the country south of the Jumna could not but realize the evils of denudation and scouring of soil by rain wash. In America "it has been estimated that 10 million acres have been abandoned and four million acres devastated due to soil erosion." And the United States Government is now awake to the fact that this is a great national loss and is a problem that must be tackled at once. In the same way the governments of Japan, Africa, and of many other countries where the problem of soil erosion is serious are taking it into their hands the task of investigating the problem and reclaiming eroded lands. Yet we believe that this problem is nowhere more serious than in the alluvial plains of India. The Department of Forestry has done some work in reclaiming certain lands as in the Etawah district in U. P., the Bombay Government also has done some work of reclamation, but we do not for a moment consider that these efforts are sufficient to tackle this very great problem which has converted some of our very rich and fertile lands into ravines where only nomads can live.

We would therefore urge all those who are responsible for the welfare of our agriculturists and of the nation to put a little thought into this matter so that this once fertile country may not be converted into a desert.

THE MANURING OF FRUIT TREES

By W. B. Hayes, M.Sc. (Ag.), Horticulturist, Agricultural Institute.

Manuring is a very important factor in fruit growing, and is likely to be one of the more expensive orchard operations. It is therefore highly desirable that an intelligent programme be followed, to develop and maintain soil fertility and avoid unnecessary expenditure. This involves not only the question of what fertilizers will increase yields or improve the quality of the fruit, but also the question of whether the benefit will be greater than the cost of manuring, and how much of each fertilizer may be profitably applied.

The final answer to these questions can only be determined by field experiments with each of the fruits, and under different conditions of soil and climate. Short cuts to this knowledge are attractive, but not dependable. Chemical analysis of the soil may show the amounts of the various elements present, but it does not show how much of each is in a form in which the plant can absorb it. Analysis of the plant, and of the fruit, indicates the amount of each element removed, but does not show whether this is more or less than is becoming available in the soil. Such analyses may suggest valuable lines of experimentation, but the actual tests can only be carried out in the field. One may calculate that a certain element is needed, but unless the trees respond to its application, it is useless to apply it.

Unfortunately, there have been few, if any, careful manurial experiments on fruit in India. There seems to be no published record of any experiment which would afford a basis for definite recommendations. Yet such recommendations are not wanting. Farmyard manure, oilcake, sulphate of ammonia, ashes, tank mud, superphosphate, potassium sulphate, bone meal, and even such substances as salt, milk and honey are more or less commonly advocated. Even Government bulletins sometimes speak with an assurance which does not seem justified. A recent bulletin of the United Provinces Department of Agriculture makes recommendations for the manuring of citrus, including very definite quantities of superphosphate, potassium sulphate, oilcake, ammonium sulphate and farmyard manure. No experimental evidence of the value of this treatment is cited.

Since experimental evidence regarding the manurial requirements of Indian fruits is lacking, is there no basis for judging such recommendations or planning an intelligent programme? Some light may certainly be secured by considering manurial experiments with fruit in other countries, experiments with other crops

in India, and the observed effects of such practices as are commonly used by fruit growers in this country. While such consideration will not afford final proof, it should give a reasonable basis for practice pending carefully planned and executed experiments. Such experiments are urgently needed, in various parts of the country, and with the main fruits. But even if adequate experiments were begun at once, it would be some years before the results would be known.

In Europe and America, numerous experiments on the fertilizer requirements of fruit trees have been carried out, and there is a large amount of evidence on record, much of it of real value. From this it appears that under some conditions, in order to get satisfactory yields it is necessary to add all three of the elements commonly used as fertilizers, nitrogen, phosphorus, and potassium. But in the case of the last two, fruit trees failed to respond on many soils on which field crops did respond. It seems that only where the deficiency in phosphorus or potassium is extreme, is it profitable to add these elements. On the other hand, fruits responded to nitrogen on practically all soils where field crops did.

Most of these experiments were with deciduous trees. It is probably that experiments with citrus trees, which are evergreen, would afford better evidence of what might be expected of Indian fruits, most of which are evergreen. There is some evidence that on the poor sandy soils of Florida, nitrogen, potassium, and some phosphorus are needed. On the other hand, only nitrogen seems to be of any value in the citrus orchards of California. There have been numerous experiments in that state, including some of the most reliable which have been conducted anywhere. The Director of the Citrus Experiment Station at Riverside, California, recently stated, "The total absence of any effect from phosphate or potash has been observed with regard to the growth of weeds, cover crops, and trees, and fruit tonnage and quality." A more definite and complete statement would be difficult to formulate. Yet the fertilizer concerns in that state continue to advertize potash as a fertilizer for citrus trees!

Foreign experiments, then, seem to indicate that fruit trees very frequently require nitrogen, and very rarely phosphorus or potassium, in addition to the amounts already present in the soil.

In India, many experiments have been conducted as to the manurial requirements of field crops, such as the grains, sugarcane and potatoes. The results are not very uniform, but again nitrogen has given the most consistently favourable response. In the Gangetic valley, phosphorus seems to be somewhat deficient in the more eastern districts. A recent review of fertilizer experiments in the Punjab stresses the value of nitrogenous fertilizers, but makes the rather surprising statement that, "the application of

phosphatic and potassic fertilizers has almost always resulted in a financial loss."

Nitrogenous fertilizers and farmyard manure, which contains all three elements, are more or less commonly used by fruit growers in this country, with obviously good results. In fact, in most places, it is not possible to grow fruit profitably without adding nitrogen. Phosphorus and potassium have not been used, except as they are found in farmyard manure, commonly enough to afford a basis for drawing conclusions.

The agreement between the results of foreign experiments on fruit, Indian experiments on other crops, and common observation of horticultural practice, is striking. The need for nitrogenous manures stands out clearly, and can scarcely be questioned. Good results are achieved with the use of farmyard manure only. Since Indian experiments show that the use of neither phosphorus nor potassium on field crops is likely to prove profitable, and since foreign experiments indicate that there is less necessity of giving these elements to fruit trees than to most field crops, it is very doubtful if either of these elements is commonly lacking in Indian orchard soils.

It has been found that in addition to whatever chemical elements are lacking in a soil, it is necessary to add organic matter in order to keep the soil in good condition and to secure satisfactory crops, of whatever kind. This seems to be particularly true of fruit trees. The growth of green manure or cover crops is therefore highly desirable. In addition, farmyard manure is of great value, as it provides both organic matter and nitrogen. If fairly large amounts of manure are used, any need for phosphorus and potassium is probably adequately met. A common recommendation for the citrus orchards of Southern California is that in addition to a green manure, one-half of the nitrogen required be supplied as a bulky organic, such as farmyard manure, and that the remainder be supplied in whatever form it is cheapest.

If part of the nitrogen is to be supplied as a chemical, it ordinarily makes little difference which form is used. If there is a tendency for the soil to become alkali, it is well to avoid nitrate of soda. On the other hand, ammonium sulphate used year after year tends to increase the acidity of the soil. But in normal soils there is little danger from the use of either of these.

Nor is the season of very great importance. The common practice of applying manure at the beginning of, or during, the rainy season, is probably a good one. If chemical nitrogen is used, it is probably best to apply it when the fruit is setting or developing.

The amount of fertilizer to use is a question of much importance.

Here again there is very little evidence as to the best practice. The question is not simply one of the amount which will give the largest crop. The law of diminishing returns is applicable. Each additional unit of fertilizer gives a smaller increase in yield than the preceding unit. The point is soon reached where the value of the increase in yield is less than the cost of the additional fertilizer. As the cost of fertilizer and the value of the fruit fluctuate, the grower must determine each year the amount of fertilizer which he can most economically use.

The requirements of the trees also vary. It is commonly pointed out that young trees need much nitrogen if they are to be maintained in vigorous vegetative growth, but it is often forgotten that a tree in full bearing needs more nitrogen to produce the crop than a young tree needs for its growth. The amount of manure should ordinarily increase from the time the tree is planted until it reaches full bearing, and thereafter be maintained at that level. However, in soils such as are common in India, in which the nitrogen and organic content is very low, it may be desirable to give very heavy doses of manure the first few years, and smaller amounts later.

Bearing orchards may profit by as much as three pounds of nitrogen per tree. This would be supplied by about 300 pounds of farmyard manure of average quality, or by 150 pounds of manure and seven and a half pounds of ammonium sulphate.

Fruit trees sometimes maintain a vigorous vegetative growth and fail to bear satisfactorily even when old enough that heavy crops should be expected. This is particularly likely to happen in regions of uniformly warm climate. In order to induce fruitfulness, it becomes necessary to check the growth of the tree. Under such circumstances it may be desirable to reduce the amount of nitrogen provided, or to omit manuring entirely for a few years.

It should be remembered that these recommendations are tentative. The need for experimentation is great, and until careful experiments have been made, the best practice will not be definitely known. If the grower is in a position to experiment with different fertilizers, it is well for him to do so. But he will be well advised to experiment on a small scale, with checks and controls, and to maintain a conservative manurial programme in his larger plantings.

Citronella oil, bane of mosquitoes comes from a grass cultivated in Ceylon and Java.

It is reported that Russia has over a thousand scientists working on problems of crop improvement.

CONSTANTS OF COW GHI AND LACTATION PERIOD OF THE ANIMALS

By Dr. B. B. Brahmachari,
Director of Public Health Laboratory, Bengal.

Report No. 66 of the University of Leeds and the Yorkshire Council of Agricultural Education finds the stages of lactation of the cows to be among the chief factors affecting the volatile fatty acids present as glycerides in the butter fat and the figures for Reichert Wollny value given in page 507 of the Minutes of evidence to the Final Report of the Departmental Council of Butter Regulations show the value of the constant to be decreasing steadily from 30.9 in the first month to 22.0 in the tenth month. Reichert Wollny value, saponification value and Refraction Reading at 40°c. Zeiss' scale are three of the constants of ghi which have been standardised under the Bengal Food Adulteration Act; for cow ghi these standard values are 24,220 and 40-42·5 respectively. I could study the influence of lactation on these constants on products of 48 cows. Their values were found to be as below:

Values of the Constants of Cow Ghi According to the Month of the Lactation Period of the Animal

Month of lactation.	Number of cows.	Reichert Wollny value.			Saponification value.			Refraction Reading at 40°c.		
		Minimum.	Maximum.	Of the blend.	Minimum.	Maximum.	Of the blend.	Minimum.	Maximum.	Of the blend.
1st ..	4	20.2	30.4	27.3	217.3	233.1	227.3	41.4	44.3	42.4
2nd ..	1	..	..	28.9	..	..	229.6	..	..	41.4
3rd ..	5	27.4	42.3	21.2	22 .1	236.4	231.4	39.8	42.6	41.0
4th ..	7	20.2	29.4	25 5	218 5	234.4	225.5	40.1	43.1	40.3
5th ..	9	21.9	29.5	25.3	216.2	235.5	224.6	39.6	44.2	44.3
6th ..	6	22.3	34.7	28.0	222.5	232.7	223.2	40.5	43 6	41.8
7th ..	7	19.5	29.0	23.0	213.9	231.9	219.9	40.4	44.6	43.5
8th ..	2	23.3	24.9	24.1	225.1	226.1	225.9	41.9	42.5	42.2
9th	6	21.0	24.2	23.1	217.7	224.5	220.0	42.8	44.1	43.5
10th	1	..	..	23.8	..	..	220 0	..	..	43.1

2. Number of animals for each month of the period was too small to give any idea of the average values for it, but they were

numerous enough to give them by the method of least square as trend values, which we find to be as in the following table :—

TREND VALUES OF THE CONSTANTS OF THE COW GHI ACCORDING TO THE MONTHS OF THE LACTATION PERIOD OF THE ANIMAL

Month of lactation.	Reichert Wollny value.	Saponification value.	Refraction Reading at 40°c.
1st .. .	29.3	227.3	40.9
2nd	28.6	226.2	41.1
3rd	27.8	225.2	41.3
4th	27.2	224.1	41.5
5th	26.5	223.1	41.7
6th	25.8	223.1	41.9
7th .. .	25.1	221.0	42.1
8th ..	24.4	220.0	42.3
9th	23.7	219.9	42.5
10th .. .	23.0	217.9	42.7

3. It will be seen from the above that the Reichert Wollny value and Saponification value of cow ghi tend to decrease steadily from 29.3 and 227.3 respectively in the first month of lactation to 23.0 and 217.9 in the tenth month, and Refraction Reading, to rise from 40.9 to 42.7 through the same months. Unless the number of animals from which the ghi is derived is too small, the constants of the blended products for any month of lactation will tend to have the trend values. Cow ghi blended of products of animals in the first four months of lactation compared with that from those in the last four months was found to have the values as below :—

Lactation period.	Number of Animals.	Reichert Wollny value.	Saponification value.	Refraction Reading at 40°c.
1st to 4th month	17	27.8	229.5	41.1
7th to 10th month .. .	16	23.2	220.1	43.3

REFERENCE

Elsdon, G. D. (1926) Edible Oily and Fats, P. 386, Publisher, London, Ernest Benn, Ltd.

INDIAN FARMING PROBLEMS

How to Build up the Wornout Indian Soils and Increase the Yield of Crops.

S. C. Chodhury.

Farming is by far the most important industry in India ; it is in fact the basic support of the whole imperial structure. But still it is conducted under highly unsatisfactory conditions and the average yield per acre of the different crops is consequently very much lower than in countries where agriculture is better organised. The following table from Indian Economics, Vol. I, by Profs. Jathar and Beri bears testimony to this fact :—

Table I

Yield per Acre in India and Some other Countries

	Wheat bushels 60 lbs.	Corn bushels 56 lbs.	Barley bushels 48 lbs.	Rice lbs.	Cotton lbs.
Canada .. .	17.8	43.4	27.6	..	..
U. S. A. ..	13.9	28.3	24.9	1,090	141
England . ..	31.2	..	31.0	..	..
Denmark .. .	39.0	..	45.6		..
France	18.6	16.	23 9	..	..
Italy	17.1	20.2	14.3	2,151	..
Germany ..	20.5	.	25.7	..	..
Egypt .. .	24.1	36 3	30.1	1,456	352
India	13.	15.6	19.8	911	98
Japan ..	22.5	27.7	31.7	2,477	..
Australia .. .	11.2	25.7	21.3	..	.

India is one of the oldest farming countries of the world. Much of the cleared land has been farmed continuously for the last thousands of years. As a rule, the cropping systems and methods of farming followed in the past have not provided for maintaining fertility and in some localities a relatively large part of the farm lands are returning crop yields so small that they are responsible for placing many farms on the border line between a profitable and a losing business. Since to-day an ever-increasing demand for food, clothing and other necessities of life is being made upon

the Empire by an ever-increasing population and as crop yield is one of the more important single factors in determining the profits from farming it is of the utmost importance to the agriculture of the country to increase the yield of the crops grown.

The first step toward solving this problem is perhaps the most difficult—the building up of soil fertility to a point at which it will produce yields large enough to put farming on a paying basis. Fortunately there are many examples of farms in Canada, U. S. A., Great Britain, France, Italy, Australia, Germany, Japan, etc., that have been made more productive because the farmers adopted improved methods of soil management. These may well serve as guides in building up the wornout Indian soils and obtaining better crop yields.

Important Factors in Soil Management.

On account of the differences in the character of the soil and the great variety of the crops grown in the different parts of the world, there is much diversity in farm practice not only in methods of tillage but also in the use of fetilizers and in other methods of soil improvement. But there is one outstanding feature in all of these different methods of building up land—the fact that in every case where the fertility of the soil has been built up and crop yields have been materially increased, large quantities of vegetable matter have been added to the soil in one form or another.

Commercial fertilizers and tillage practices play an important part in crop production but the general results that have been obtained so far indicate that humus is one of the most important factors in the improvement of the soil and that crop production depends largely upon the quantity of decayed vegetable matter in the soil. On some of the poorer low-yielding land, for example, a good growth of sunn-hemp or *dhaincha* turned under doubles the yield of the succeeding crop. In many instances farmers have ploughed under three crops of crimson clover in succession and have brought their land up from a condition in which it produced only 15 bushels of corn per acre to a point at which it produced more than 50 bushels per acre. This indicates that as the organic matter is increased in the soil the yields of crops also increase.

The presence of organic matter benefits land in several ways. It increases the bacterial activity in the soil so essential to crop production. It causes water to be absorbed more readily and thus lessens the danger from washing. Soils well supplied with organic matter are more retentive of moisture and heat, remain more friable, are easier to work and are likely not to become hard or form crust after rains. The chief source of nitrogen in the soil is the breaking

down and decay of organic matter in the soil and nitrogen is the element lacking in the majority of our soils.

The big problem in building up the wornout soils in India is to get organic matter into the soil and to do it economically. In the farm practice there are three principal sources from which humus is usually supplied—Farm Manure, Crop Residues and Green Crops turned under.

Farm Manures.

Farm manure is a most valuable source of fertility on many of the farms. In addition to supplying considerable nitrogen, some phosphoric acid and potash, it is an important source of humus. In parts of the country where the type of farming always includes live-stock enterprises, the manure from the animals is the chief reliance for maintaining the supply of organic matter in the soil. A 1,200 lbs. horse will produce about 11 tons of excrement per year, which together with the bedding will make about 14 tons of manure. A cow produces a little more, but about the same amount of dry matter. A fairly safe rule for any stock, except poultry and hogs, is to count one ton per month for each 1,000 lbs. of animals kept. This is usually sufficient to maintain the organic matter necessary to good crop production. But often it is difficult to maintain the normal supply of organic matter even on farms heavily stocked with animals. So it is always a healthy practice not only to use all the available manure but to increase still further the organic matter in the soil by turning under crop residues and green crops.

The importance of supplementing the farm manure with organic matter from other sources is well illustrated by the results obtained on a dairy farm located on light sandy land in Anne Arundel County Md. (U. S. A.). The crops grown were corn and cowpeas in a 2-year rotation. Two hundred pounds of acid phosphate per acre were applied to each crop. In addition to the roughage produced by the corn and cowpeas, grain was bought and fed to the cows. In spite of the fact that all of the manure thus produced by the cows and work stock was returned to the land, the crop yield steadily declined until the cropping system was rearranged to provide a greater quantity of organic matter in the soil. This was accomplished by sowing crimson clover in the corn and ploughing it under the cowpeas.

Crop Residues.

The roots and stubble left in the soil after crops are harvested constitute an important source of organic matter. The quantity of this material left from crops varies according to the nature of the

crops, those left from such crops as corn and wheat harvested in the usual way is not large but where systems of farm management which leave practically the entire crop on the field are followed, the quantity of organic matter thus added is much greater. It might be interesting to know that a good stiff timothy sod has about 2 tons of roots per acre, $6\frac{2}{3}$inches ; a blue grass sod $6\frac{1}{4}$ tons, while the old "blue steam" prairie sod contains $13\frac{1}{2}$ tons of roots.

Supplying organic matter by methods which turn back as great a quantity of residue as possible ordinarily does not receive sufficient attention in our farms. The cropping system that does not provide for maintaining an abundance of organic matter in the soil is of little value in building up fertility. Merely alternating the crops is not sufficient. Hay and pasture land should be ploughed while there is a still good sod. Weeds, corn stalks, straw and other material of this kind are valuable sources of organic matter.

Green Manure.

Indian farmers do not keep a large number of cattle and they use the manure as fuel. As a result little manure is available for soil improvement on the average farm and most farms much rely on other sources for the organic matter necessary to keep the land in a productive condition. Most of the progress in building up the low-yielding soils has been made by arranging the cropping system to include one or more crops to be turned under at regular intervals. In some instances it has been necessary to plough under several crops before sufficient fertility could be accumulated to produce yields large enough to be at all profitable. This involves considerable expense but in extreme cases it is doubtless good practice.

In using green manure crops as a means of soil improvement it is of distinct advantage to use legumes so far as possible. These crops add to the organic matter and supply large quantities of nitrogen, the most expensive element that is bought in the form of commercial fertilizers. If legumes are grown regularly and are ploughed under on the different fields the nitrogen required for the growth of the other crops will be supplied and much money may be saved which would otherwise have been expended on fertilizers. In the Illinois Agricultural Experimental Station (1905) an increase of 16·9 bushels of wheat per acre has been reported due to the ploughing under of cowpeas. The same Experimental Station also reports that in the case of maize the yield per acre has increased by 9·8 bushels where legumes were used as a green manuring crop.

Commercial Fertilizers.

Except for potatoes and truck crops, it is wise economy to use commercial fertilizers in a definite plan of permanent soil improve-

ment rather than to make light applications principally for the purpose of stimulating the one crop to which they are applied. It is doubtless good business practice to apply fertilizers to a crop and thus increase the production over and above the cost of the fertilizers and the extra labour, but it is still better to accomplish this in such a way as to effect a more permanent improvement of the soil which will serve to benefit several crops in succeeding seasons.

The soils of India need nitrogen and humus first of all. The full effect of fertilizers cannot be realised on the average soil of India until this need has been met. After this the application of phosphorous is of great importance and on the lighter soils especially the application of potash is distinctly beneficial. The nitrogen is most economically supplied by growing legumes and turning under crops. Phosphorous is usually supplied in the form of superphosphate. For general purpose potash is best supplied through the use of muriate of potash or Kainit.

The fertilizer practice that has given best results on most of the farms of the western countries follows the general plan of applying the fertilizer to the crop that is grown especially for soil improvement. Two or three hundred pounds of superphosphate, for instance, applied to crimson clover that is to be turned under for corn, gives much better returns under the average soil conditions than does the same quantity applied directly to the corn crop. The best practice, as the experiments at different experiment stations show, is to apply the fertilizer to the legumes and grass crops grown to supply the nitrogen and organic matter necessary to the building up and maintenance of fertility in the soil. (Maryland Experimental Station.)

The soils of India generally need lime in addition to the fertilizing elements that are used. Although an application of lime is generally beneficial in growing legumes and assists in the improvement of the soil, it is often difficult to tell whether lime or organic matter is needed more. In numerous instances the beneficial effects attributed to lime on especially poor soils are secured with equal effectiveness by adding large quantities of organic matter. (California Experimental Station.)

The following tables are intended to give our readers some idea as to the increase of crop yields due to the different kinds of soil treatment :—

Table II

CROP YIELDS. VIENNA SOIL EXPT. FIELD.

BUSHELS PER ACRE.

Red silt loam.	Oat Series. Total yield.	Wheat Series Total yield.	Wheat Series. Total yield.
Treatment applied	1902	1903	1905
None	19 1	0.4	1.3
Legume	18.8	0.6	10.8
Legume and Lime	19.8	0.7	18.2
Legume, Lime and Phosphorous ..	20.0	8.0	25.6
Legume, Lime Phosphorous and Potash	31.7	11.0	30.0

Table III

CROP YIELDS. VIENNA SOIL EXPT. FIELD.

CORN BUSHELS PER ACRE.

Red Silt loam.

Treatment applied ..	1902	1903	1904	1905	1906
None	15.5	9.3	30.5	37.5	41.2
Legume . ..	13.3	5.0	35.5	42.9	40.6
Legume and Lime ..	14.9	8.3	49.1	61.9	48.9
Legume, Lime and Phosphorous ..	12.5	7.4	49.4	57.2	40.9
Legume, Lime, Phosphorous and Potash	19.9	11.6	44.7	56.5	40.9

CROPPING SYSTEMS

Comparatively very few farmers in India follow a definite crop rotation. Although a fixed rotation is in many respects very desirable from the standpoint of soil improvement, it is not absolutely necessary and in many cases not desirable. It is always the best for a farmer to follow a cropping system that is more or less flexible so that a shift in the order of cropping can be

made when a change in prices or variation of seasons make a change necessary.

In beginning the improvement of land, it is generally preferable to start with a more or less definite succession of crops which may later be changed to a system more suited to the type of farming of the locality or to the type that is being followed. On the poorer lands the best results are obtained by starting with a system of cropping that emphasizes the growing of crops for the express purpose of increasing the organic matter in the soil. The following is a good example :

First Year	... Cowpeas followed by rye.
Second Year	... Cowpeas followed by crimson clover.
Third Year	... Corn followed by alfalfa.

(Iowa Expt. Station).

On lands that are not extremely run down and that are still producing fair crops such radical measures will not be necessary. In many cases a legume or other humus-forming crop can be included in the cropping system without much extra expense. Under some conditions—, as for instance, on the farms that grow a variety of small fruits and truck crops—it is desirable to grow the same crop continuously on the same land. This is especially true of paddy, jute and corn. There are a number of examples of this being done successfully under the following plan of cropping :

First Year	... Rice with dhaincha sown at last cultivation.
Second Year	... Dhaincha turned under, rice again planted.
and succeeding years	Dhaincha or any other legume sown at last cultivation. (This is almost universally followed by the paddy cultivators of Assam and Bengal.)

A system of farming that has maintained crop yields on the farms of a large estate in eastern Maryland will be of much interest to our readers. The records kept by the estate a few years ago showed that crop yields were then about the same as they were 30 years ago—corn 30 bushels, wheat 17 bushels, clover hay $1\frac{1}{2}$ tons per acre. These yields are not large, but they have been maintained for a long period in a section where yields of the same crops on adjoining farms are very much lower. The soil ranges from a sandy loam to a clay loam. The crop rotation practiced is :

First Year	... Corn.
Second Year	... Wheat.
Third Year	... Clover for hay and pasture.
Fourth Year	... Wheat.
Fifth Year	... Clover for hay and pasture.

All of the wheat and about three-fourths of the corn grown are sold. The hay and one-fourth of the corn are fed, the corn stover and wheat straw are utilised as feed and bedding, and the manure is returned to the land. The manure is spread on the clover sod and turned under for corn. Each wheat crop is fertilized with commercial fertilizer analyzing 2% nitrogen, 8% phosphoric acid and 2% potash at the rate of 300 lbs. per acre.

The essential difference between the system of farming on this state and on other farms of the community is not so much in the fertilizer used as in the rotation and disposition of the crops—a 5-field system with two of the fields in clover each year as against a 5-field system with one field in clover each year.

The production of small fruit and truck crops requires special attention. When farms are devoted largely to growing truck and small fruits provision must be made for supplying organic matter to the soil if yields are to be maintained. Organic matter can usually be supplied in such cases by growing rain cover crops of crimson clover, cowpea, vetch, rye, or dhaincha. These cover crops can be grown after such crops as potatoes, tomatoes and also in standing corn to good advantage. The following 4-year rotation which provides for growing feed for livestock and for some wheat and truck crops for sale, is well-adapted to such farming and will rapidly improve the land:

First Year	...	Corn. Cowpeas sown at last cultivation of the corn to be disked in for wheat.
Second Year	...	Wheat. Red clover sown on the wheat in early spring.
Third Year	...	Clover cut for hay.
Fourth Year	...	One-half in tomatoes followed by crimson clover.
		One-half in potatoes followed by crimson clover.

(Oregon Expt. Station.)

Numerous other cropping systems are in use and some are effective in building up and maintaining crop production but these examples illustrate some of the more important features to be considered in formulating systems suited, in whole or in part, to most general farms of the country.

Practical Considerations.

Building up the fertility of the soil is an economic as well as an agricultural problem. Expenditures must be justified by the increase in crop yield either at once or at some time in the near future. The kind of crop grown and the price received are import-

ant factors since these affect the margin of profit and consequently the amount of money available for land improvement and development.

The rate at which this improvement is to be made must be governed to a certain extent by the amount of capital available for the purpose. If the necessary capital is available, the improvement can be carried on rapidly and the soil built up in a comparatively short time. With little or no capital available more time is necessary and the improvement must be brought about gradually. The latter course has its advantages in that it gives more time for becoming familiar with important details and invites less danger from losses through putting more money into the soil than returns will warrant. Such losses may occur when the improvement is brought about rapidly.

The type of farming should be made to conform to the conditions on the individual farm. For the man with small capital, crop farming is much more simple and more desirable type, for a few years at least, than is livestock farming. There is an advantage, however, in keeping enough livestock to utilise feed that might otherwise be wasted, the manure being returned to the land. However all the real advantage in keeping livestock for the manure alone can easily be gained by using small quantities of fertilizers and ploughing under green crops. In starting to improve farm land the tendency to rush into livestock farming before conditions warrant the change should be studiously avoided. It is the part of wisdom to increase the livestock gradually as the soil is built up to a point at which an abundance of feed can be produced easily, and as sufficient capital to buy fences and livestock equipment is accumulated. But in the beginning and for a considerable time thereafter crop farming and the sale of cash crops have a decided advantage in simplicity of operation and quicker and surer returns.

Examples of Soil Improvement.

The examples of soil improvement given in the following lines have been selected from among a large number of farms on which the crop yields have been increased by making the land more productive through the use of legumes and other crops grown to add organic matter to the soil. The crops and methods employed, with a few of the results obtained on each farm, are briefly described.

A Corn Farm (U. S. A.)

The regular practice on a certain corn farm was to grow corn one year in three allowing the land to rest for two years before another crop was planted. During the resting period grass and

weeds were allowed to grow up to accumulate fertility for the next crop. Under the system of cropping the yield of corn ranged from 15 to 18 bushels per acre.

The first step in the soil improving programme on this farm was to plough and plant one of the field to cowpeas. The cowpeas made a fair growth and were cut for hay early in September. The stubble was then disked and seeded to crimson clover. The following spring the crimson clover was turned under and the land was planted to corn. At the last cultivation of the corn, crimson clover was again turned under and the land was planted to corn. This practice was continued for five successive years on the same field. The yield of corn increased from 18 bushels to 40 bushels per acre in three years. The fifth corn crop made a yield of 50 bushels per acre.

A Cotton Farm (U. S. A.)

A farm had been parcelled out to tenants for growing corn and cotton on share basis. Little or no provision had been made to keep up soil fertility except through the use of small quantities of commercial fertilizers. Under this system of farming the crop yields declined to the point at which tenants no longer found it profitable to work the land and the farm changed hand.

The new owner with a very limited amount of capital at once began to improve the soil by growing cowpeas, rye, and crimson clover to be turned under. One field was planted to cowpeas with an application of 20 lbs. of superphosphate per acre. The cowpeas were cut for hay and the next spring the land was planted to cotton with an application of 200 lbs. per acre of a 2-8-3 fertilizer. The yield of cotton was one-third of a bale per acre. Another field was planted to rye in the fall and was turned under for corn for the following spring. The yield of corn was about 20 bushels per acre.

From this beginning the following two-year rotation was put into operation :

First Year ... Cotton plus crimson clover after first picking.

Second year ... Corn plus cowpeas at last cultivation.

In this rotation crimson clover was sown in the cotton either at the last cultivation or after the first picking depending on the moisture conditions of the soil. Cowpeas were sown in the corn at the last of cultivation. The essential difference between this rotation and that previously used on this farm is that cowpea stubble was turned under for corn and a crop of crimson clover was ploughed under for corn each year. This difference in the system of cropping increased the yield of cotton from 100 lbs. of lint per acre to more than 500 lbs. per acre in four years, and the yield of corn from 20 bushels per acre to 40 bushels during the same time.

Corn Continuosly For 25 Years (U. S. A.)

This farm furnishes an excellent example of the possibilities of building up the fertility of the soil while the land is producing a crop of corn each year. The soil is sandy with a porous subsoil and had been so reduced in fertility that the yield of corn was only 12 to 15 bushels per acre. When the practice of sowing crimson clover in the corn was begun, corn was grown continuously year after year on the same field for 25 years. Each year crimson clover was sown in the corn at the last cultivation. The following spring the crimson clover was cut for hay and the stubble was ploughed under in preparation for the next corn crop. Each corn crop was fertilized with 250 lbs. per acre of fertilizer made up of equal parts of 14 per cent. superphosphate and kainit. The land was ploughed 6 or 7 inches deep and the corn was cultivated to keep down the weeds. The yield of corn was increased from 15 bushels to more than 40 bushels per acre. In addition an average of at least a ton of crimson clover hay per acre was cut annually.

Examples From India.

Very little work has been done in India. The very little that has been done uptil now under the auspices of the Department of Agriculture show that there are enough of possibilities in this direction. The Burdwan Experimental Station has found out that if jute is used as a green manure in the cultivation of rice the profit increases from Rs. 20 to Rs. 55 per acre. They have also discovered that a mixture of saltpetre and bonemeal trebles the crop and raises the profit from Rs. 20 to Rs. 100 per acre.

Cotton when cultivated without manure has been found to yield only 403 lbs. per acre. But when cultivated after green manuring there is an increase in the produce from 403 lbs. to 679 lbs. per acre. (Central Cotton Committee Report.)

Jute cultivated without manure has been found to yield 3½ maunds per bigha but when cultivated with Sodium Nitrate the produce per bigha is increased from 3½ maunds to 64 maunds per bigha. (Bengal Agricultural Department).

* * * *

The writer is fully convinced that a readjustment of crops and their succession, a judicious and economical use of fertilizers, the broadening of operations on the farms of the farmers and greater intensification of farming for the whole country, will place the returns of Indian farming alongside of the most favoured sections of the world.

CONTROL MEASURES AGAINST INSECTS

By W. K. Wesley, M. Sc. L. T.,

Professor of Entomology, Allahabad Christian College.

"Control measures against insect pests are simply the application of methods appealing to one's common sense after having taken into consideration :

(*a*) The conditions under which the crop is raised,

(*b*) The kind of crop,

(*c*) Any cultural methods adopted in raising that crop, and

(*d*) The detailed and accurate knowledge of the life-history of the particular pest.

In devising any methods of control, it is very necessary that the pest should be studied from all points of view, in order to find out the weak spots at which it can be tackled most effectively."

Classification of Control Measurers.

I. Applied Control.

1. *Chemical Control:—*

(*a*) The use of Insecticide : Substances that kill insects by their chemical action.

(*i*) Stomach poisoning: Sprays, dusts, or dips that kill the insects when swallowed, *e.g.*, arsenate of lead or calcium, paris green, sodium flouride, etc.

(*ii*) Contact poisons : Sprays, dusts or dips that kill the insects when they come in contact with them, *e.g.*, nicotine preparations, lime-sulphur, oil emulsions, etc.

(*iii*) Fumigants : Substances used in the form of a gas to kill the insects, *e.g.*, Hydrocyanic acid gas, carbon bisulphide, carbon tetrachloride, etc.

(*b*) The use of repellants : Substances that due to their offensive odour drive away insects, *e.g.*, Bordeaux mixture, creosote, napthaline, citronella oil, etc.

2. *Mechanical Control :—*

(*a*) Hand destruction ; hand picking : (*ii*) jarring, (*iii*) swatting, (*iv*) warming.

(*b*) Mechanical exclusion: (*i*) screening, (*ii*) tree-banding, (*iii*) linear barriers, (*iv*) fly-nets.

(*c*) Use of (*i*) traps or collecting and (*ii*) crushing machines.

(*d*) (*i*) Artifical cooling, (*ii*) superheating, (*iii*) burning.

(*e*) (*i*) Flooding, (*ii*) draining, (*iii*) dehydration of breeding media.

(*f*) Use of electricity.

3. *Cultural control or use of farm practices:*—These are regular farm operations performed so as to destory insects or prevent their injuries :

(*a*) Crop rotation.

(*b*) Ploughing.

(*c*) Suitable time of sowing and harvesting.

(*d*) Suitable method of sowing.

(*e*) Removal of crop residues, weeds, etc.

(*f*) Selection of resistant varieties.

(*g*) Pruning and thinning.

(*h*) Fertilizing and stimulating vigorous growth.

(*i*) Growing of mixed crops.

(*j*) Irrigation.

4. *Biological control:*—The introduction, encouragement and artifical propagation of predaceous and parasitic insects, other animals and diseases :

(*a*) Protection and encouragement of insectivorous wild birds and other animals like frogs, toads, lizards, non-poisonous snakes, etc.

(*b*) Use of domesticated fowls, partridges, quails, etc.

(*c*) Introduction, artificial propagation and colonization of parasitic and predaceous insects, like braconid flies, dragon flies etc.

(*d*) The spread and increase of fungal, bacterial and protozoal diseases of insects and the liberation of infected insects.

5. *Legal control*:—The control of insects through guided human activities.

(*a*) Inspection and quarantine laws to prevent the introduction of new pests from foreign countries or their dispersal within the country.

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PIGEONS AND THEIR ECONOMIC UTILITY

(By Rashid A. Munshi, B. Ag. Dip. Forestry, N. Wales.)

Pigeons are favourite pursuits of man both for fanciers and for utility. They have been neglected due to ignorance and want of suitable organizations and clubs throughout the country. To-day we find these in a hopeless mass of unrecognisable breeds and unless and until some efforts are made to identify these according to their plumage and colour; homing qualities, and above all for specific squab-industries—there seems little hope to revive this much neglected line of work.

Pigeons are found in barn lofts, church steeples and public parks. There is many a loft where these are being reared indiscriminately without any attempt to keep up either their purity or utility—as found in the Western countries. These may be considered under the following heads:

(1) *Fancy Pigeons.*—Scandaroons, Turbits, Owls and Oriental Frills.

Among pigeons as among men there are "Long-nosed" (Scandaroons) and "Pug-nosed" individuals. One of the most popular groups of fancy pigeons is made of the pug-noses or the so-called "Short-faces" which includes Turbits, Owls and Oriental Frills. This group shows varied discrepancies in its plumage colours, shapes and sizes. Some of our best known types seem to have been lost due to negligent breedings.

(2) *Racing Pigeons.*—Carriers, Dragoon, etc. Pigeon racing was a national sport in Belgium once. Light birds make sprinters but the big ones go the route. A good average speed under fair racing conditions is a little more than 1,200 yards a minute. In olden days pigeons were raced only short distances from 10-30 miles, but during the recent times they are flown even from 500-1,000 miles.

Racing pigeons have pedigrees like racing horses and they are bred and trained with care. A racing bird weighs about 16 oz. Its other qualities being :—

(*a*) Its carriage is bold and smart.
(*b*) Head strong and powerful in appearance.
(*c*) Wing feathers overlap each other without any breaks. Good length and breadth of feather are usually seen and at full spread the wing should look like an inverted letter V.

(3) *The Utility Pigeons.*—Runts, Carnaux, King Mondaines, etc. There are several varieties for the table but the most common have been noted above. Pigeons are good to eat and if one breeds only from the best there is certain to be plenty for the squab-industry. The young pigeon is heavier at four weeks when it is just ready to leave the nest than at any late period of its life. It

is fat and soft and makes one of the finest delicacies served to-day, being especially good for convalescents and children. These if given plenty of room and good feed produce from 10-14 young yearly. The most profitable squab-plants are those operated by workmen, as a side issue after regular hours. This industry is found to be profitable and interesting as compared to poultry even. From experience of my own work I find that :—

1. *Poultry.*		*Pigeons.*
(*a*) Eggs after mating—8 days.	...	6 days.
(*b*) Incubation period 21 days	...	17 days.
(*c*) Adults within 6 months	...	3 months.

2. Poultry plants are expensive while these squab unit-houses can be laid out economically and almost double that scale.

3. Squabs are delicious, lovable creatures easy to handle and seldom suffer from any serious diseases. In poultry contagious diseases are not only common but they are seen to take heavy tolls.

4. Pigeons as compared to poultry provide great field for a student of research aptitudes especially for breeding purposes.

In conclusion I may add that a taste and interest for breeding and rearing pigeons for specific purposes is to be enthused and created. To-day there seems very little hope to regenerate our old and lost types as a majority of bazar-lofts show indiscriminate pattern-mixtures and neglect. It is of importance to establish suitable clubs in the districts, advocate and advertise their cause and bring this industry into the forefront.

Pigeons and poultry should go hand in hand and never be separated or neglectd from our meagre list of cottage-industries in the country.

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(*b*) Laws to enforce the application of control measures, like spraying, cleaning up of crop residues, fumigation and eradication measures.

(*c*) Insecticide laws to control the manufacture and sale and prevent the adulteration and misbranding of insecticides.

II. **Natural control.**—All those natural measures that check or destroy insects independent of man.

(*a*) Climatic factors like rainfall, sunshine, heat, cold and wind, etc.

(*b*) Topographic features like rivers, lakes, mountains, kind of soil and other characteristics of the country that act as barriers.

(*c*) Predators and parasites naturally present in the region including insects, amphibians, reptiles, birds and mammals.

THE RECENT AGRICULTURAL REVOLUTION AND ITS EFFECT ON LIVING STANDARDS

By Mason Vaugh, B. Sc. (Ag.), A. E., Agricultural Engineer, Agricultural Institute.

My title presupposes an Agricultural Revolution. The question as to whether there has been a revolution is controversial and opinion is not agreed; there is still less agreement as to who is responsible for it if there has been one; perhaps the most violent disagreement can be secured over whether it is a good thing or not. I shall endeavour to develop the thesis that there has been a revolution in agricultural practice, that the one great outstanding cause has been the work of the engineer and the inventor, and that, while all revolutions cause growing pains, the ultimate result of this one will be a higher standard of living for every one.

I define a revolution in the sense I am using it as a change in conditions so quick and so great as to cause dislocation of the economic structure and even distress among the workers concerned. We are all familiar at least in a general way with the Industrial Revolution which started in England with the introduction of steam power. My thesis is that such a revolution is now going on, checked of course in its rapidity by the much larger number of workers involved and accelerated and masked by other factors, in agriculture, not only in one or two countries but throughout the world.

The standard of living has always been and must always be a function of the ability to produce per individual producer. Man's ability to produce has always been dependent on the facilities with which he worked. In the production of food, primitive man was limited to what he could find or kill wild, with the coming of a settled life depending on Agriculture, man very early developed the primitive plough and domesticated animals to draw it. He also early developed most of the crops on which we now depend in substantially their present forms. Of course there has been improvement and transfer from one continent to another but the sum total of gain in yield due to plant breeding and better agricultural practices has in many instances done little more than keep pace with the harm done by insect and disease spread from one district or country to another. The increase in yield per acre has been surprisingly little and we have the testimony of such eminent plant breeders as Mr. Howard to the effect that it is relatively difficult to increase yield by 10 per cent. through breeding better varieties.

Agricultural experts and economists have given a surprisingly large part of their attention to yields per acre and relatively little attention to yield per man. While high yield per acre is desirable,

the really important thing is production per worker. Leaving aside any question of inequitable distribution of the fruits of labour, we can have as a common stock of goods to divide among us, only what we can jointly produce. If we require as at present in India, 75 per cent. to 80 per cent. of the population to produce the required food (a larger percentage of the population is "rural" but some of them are not strictly producers of food), it is obvious that we can only have the production of the remaining 20 per cent. to 25 per cent. in the form of clothing, housing, transportation, government services and culture, including the "idle rich." We have only two means of increasing the supply of these other elements in a high standard of living—either we must increase the production per worker or increase the number of workers. Decided progress in increasing the production per worker began with the Industrial Revolution in England ushered in by the application of steam to spinning and weaving. This progress has gone on as mechanical power has been applied in greater and greater amounts to industrial production. What has happened to Agriculture?

Undoubtedly, the first agricultural revolution was caused by the yoking of domesticated animals to the plough. This occurred so far back in antiquity that no one knows when it happened. The primitive plough continued to be the main and nearly the only important agricultural implement until recent times and in India is still the most widely used. It is now only beginning to be displaced by modern implements.

The modern agricultural revolution which is the cause of much of the present world depression began with the development of the cast iron plough just at the end of the 18th century. The invention of the reaper for mechanically harvesting grain crops in 1832 and the steel plough in 1837 put it in full swing. The increased production resulting from these inventions released men and made available capital for investing in other equipment which was rapidly developed. The last quarter of the 19th century saw the development and perfection of the internal combustion engine and the first decade of the present century saw rapid progress being made in adapting it to the use of the farmer in the form of automobile, truck and agricultural tractor. The outbreak of the World War in 1914 found it already developed to the point of immediate practical use but still capable of improvement.

The War provided a powerful stimulant to the agricultural revolution already in full swing. On the one hand, millions of men were withdrawn from agriculture and industry at the most productive stage of their lives to go into the armies, many to die. Industrial production had to be stepped up rather than decreased to provide war supplies. The need for food was intensified due to devastated areas, food destroyed in ships sunk at sea and the

normally heavy demands of armies in the fields. This increased food supply had to be produced with a reduced force of labour. The natural result was a large increase in the use of machinery. Increasing use stimulated production and perfection of new and better types made from better materials.

Until the war, the development of machinery had gone on slowly, the men displaced or rather released from agriculture being absorbed into industries which were developing at the same time. The rather sudden spurt during the war increased the productive capacity more rapidly than the distribution facilities and the general economic system were devoloped to care for it. With the sudden cessation of the artificial demand of the War, the world found itself with a highly developed productive capacity and an antiquated distribution and financial system. The Industrial Revolution in England dislocated things badly enough. Here we had an agricultural revolution coinciding with an industrial revolution nearly as great. The result is the present depression.

For the benefit of those who may doubt this explanation, we may approach the matter from a different angle. In the area around Canton, China, and in certain districts in India, we find the densest agricultural populations in the world. Their cultivation is done by hand methods and the yields per acre are among the highest in the world coupled with yields per man among the lowest and poverty perhaps the most abject in the world. The average area cultivated is about two acres per family. In most of India, equipped with a *deshi* plough and an ordinary pair of bullocks, a man can, with the help of his wife and children cultivate about five acres. With the same bullocks but a slighty better plough such as the Meston or similar ploughs, the area rises to about 7·5 acres. With better bullocks and still better ploughs and perhaps other implements, the area per pair of bullocks can be increased to 10 to 15 acres but the man will then require more help for harvesting than his family can ordinarily furnish. These figures apply to conditions in the Indo-Gangetic plains of Northern India. In some areas where the rainfall is better distributed and cultivation less intense, the area can be increased to 15 to 20 acres. With the greater power and speed furnished by several big horses and with suitable implements, the area a man can handle single handed rises to 125 to 150 acres. With tractor implements and a suitable tractor, a man can handle almost single handed, up to 200 acres. With the largest size of tractors and suitable implements, two men can, under the most favourable circumstances and when growing only small grains, mostly wheat, handle up to 2,000 to 3,000 acres of crop and produce up to 15,000 bushels (roughly 11,500 maunds). Even ruling out the last instance, the others provide sufficient evidence of the effect on production of the imple-

ments used. The yields in each case would compare favourably with those secured by working a holding of only 3 to 5 acres.

We can approach the problem from another angle. Perhaps the greatest improvemet has been made in the production of the small grains such as wheat. Hundred years ago, just before the introduction of mechanical harvesting and further improvements in the plough, about 58 hours of man labour and 26 hours of horse labour was required to produce an acre of wheat, yielding 15 maunds per acre. Even now in India with prevailing methods and the *deshi* plough it requires 82 man hours and 152 bullock hours for preparing the soil and seeding, 64 man hours for harvesting and 40 man hours and 64 bullock hours for threshing, a total of 186 man hours and 216 bullock hours. Now, on land best suited to the use of machinery in the production of wheat, it is possible with big machinery to produce an acre of wheat with 3·3 hours of man labour and 2 hours of tractor-machinery labour. Even allowing for the labour to build the tractor and translating it into man labour entirely, the total required is only about eight hours. We can stop far short of the big machinery figure and still have a great increase over the returns from working with the *deshi* plough.

I think it unnecessary to further belabour the point that there has been and still is in progress an agricultural revolution. It has come about because of the work of the engineer. Most of the efforts of the plant breeder and the soils experts have been absorbed in maintaining the fight against insect and disease. What is of greater interest to me and I believe to you, is the social aspect of the problem. Two phrases have had wide currency in recent years, "technological unemployment" and "the machine is enslaving the man." To see the full social implications of this agricultural revolution, it is necessary to deal with these two ideas separately.

The white collar sociologist who talks about the machine enslaving the man simply doesn't know what he is talking about. Of course, if we accept the idea that the bulk of mankind is better off when compelled to work long hours daily to earn the bare necessities of life, the machine is to be left alone. It is not alone how many hours are required to accomplish a result but the physical labour required. No one who has walked weary miles in hot sunshine to plough an acre or cut wheat in the blazing heat of April and then carried the bundles from the field on his head getting the beards down the back of his neck in the process, and then performed the same operations by sitting on the seat of a tractor under a sunshade will talk that way. One of the first gains to result from mechanisation of production has been the freeing of the women folk from field labour. I can recall how in my boyhood, it was necessary for my own mother to labour long hours in the

fields in addition to the time she had to spend feeding our family. The first fruits of mechanisation of agriculture are the release of the women folk to home making and of the children from the field to the school. Equally, the mechanic who has chipped and filed and sweat over forge and anvil would be greatly amused at the idea that the machine which he has only to stand or sit and watch and to keep supplied with material is his master when it permits him to finish his work in half the time his fathers had to spend over a much smaller production. There may be a sentimental association with *charka* and handloom but a census of workers who, having worked in a spinning factory or weaving mill, have quit and gone back to them because of the "freedom" they conferred, would be interesting.

The idea conveyed to most people by "technolgical unemployment" is equally vague and unreal to most people. Except for the favoured few, the struggle for enough to keep soul and body together, the fear of famine has been a constant and terrifying nightmare to mankind. Periodically famine has stalked the land taking thousands while the absence of sufficient clothing, decent housing and other amenities of life has been so constant as to be accepted as inevitable, a part of *karma* or *kismet*. Dire predictions of a starving world unable to feed and clothe itself were made as late as 1898 when Sir Willam Crookes predicted a starving world "within a generation." In the period since then we have passed from the era of scarcity to that of plenty. Production has been so tremendously accelerated not only in industry but in agriculture in the last few years that we have been popped out into the sunshine of plenty before we had time to develop protecting pigment, like a white ant whose tunnel was broken.

The real product of mechanisation of production is leisure coupled with plenty for everyone. In the past, leisure and plenty were the prerogative of the few. Now, they can become the right and privilege of everyone. The real problem facing the world now is not that of raising prices or restricting production. It is that of replanning distribution so that everyone may have the opportunity to produce and to exchange his production with others so that all may have a satisfying and happy life. If our social organisation and economic life can be replanned with this in view, there will be no need for anyone to be unemployed or deprived of those things which go to make a high standard of living. The right use of our productive capacity will not only provide food and clothing, housing and transportation and other material comforts but that leisure which is necessary for the highest development of man. In planning the future, we must give attention to not only material prosperity but to the religious and social culture which is the basis of true happiness.

A PLEA FOR COW TESTING SOCIETIES FOR THE IMPROVEMENT OF CATTLE BREEDING

By A. N. Sanyal, Inspector, Co-operative Societies, Etawah, United Provinces.

(Continued from last issue.)

Scheme of the Organisation of a Cow Testing Society. In the Ghee Societies under Parna Central Co-operative Bank, Ltd.

1. At present only the quantity of milk produce can be measured, *i.e.*, only milk recording can be done. There cannot be any arrangement for the testing of butter fat as it is rather of a technical nature.

2. The number of villages to be organised into a society should be for the present as an experimental measure confined to 7 to 10 situated very close to each other.

3. An exclusive supervisor is to be employed for the purpose whose work would be nothing but Milk Recording, *i.e.*, weighing the quantity of milk and noting the feeds given.

4. With regard to the interpretation of these data he would have nothing to do. His work would be simply that of recording these data.

5. Anybody becoming a member of such a society would have to pay rupee one for membership fee every year. For the present, it has to be kept very low in order to encourage them to organise themselves into societies. (The idea is that the membership fee is to be charged on the number of cattle.)

6. The breeding bull is to be supplied by the Government Cattle Breeding Department free of cost. This would be handed over to one member for proper care and feed for which he would be paid something every month to meet the expenses of the bull.

7. In order to encourage the members no charge would be made for the service of the bull in cash but every member taking the service of the bull would have to pay say 5 srs. of grain (gram, oil cake, etc.) for the service. A penalty clause would be inserted that any member not taking the service would be fined Re. 1 for every cow or buffalo served by a different bull.

8. In order to minimise the vigour of rule 7 and in order to encourage the members for better cattle breeding and cow testing, annual prizes should be given to all the members for the calves out of this bull. A special prize to be given to the best calf.

9. The calves of this breeding would not be allowed to be sold to any outsider but sales are to be confined to the members of the society as far as possible in order to replace the old stock.

The members are to be encouraged to keep these calves themselves. In order to encourage this, members possessing their own calves for two years and more are to be given special prizes for the best calf.

10. In order to facilitate the work, the co-operation of the Zamindar, the District Board, the Government through the Cattle Breeding Department and through the Co-operative Department are necessary.

11. The help of the Zamindar is needed in the following :—

(*a*) In order to facilitate and encourage the members to produce more fodder, he may make a small concession to those who are producing fodder in more fields.

(*b*) In Bah Tehsil, where the villages border the ravine and forest lands, the Zamindar may allow the grazing of cattle of those who are members of the cow testing society free, or on a very small fee with the restriction that no trees are to be cut down.

(*c*) In case of dispute about the cutting down of trees, the matter is referred to a Panchayat composed of the members of several societies only and the Zamindar should not be in the Committee.

(*d*) That the Zamindar should allot lands in the ravines free of cost and encourage them to plant trees in them with suitable clauses equitable to both the parties. This would also help the stopping of erosion of the land in the Agra District.

(*e*) Where there are no village Shamilat the Zamindar may set apart an area—the farthest from the village site on a very small rental to be given out to the society. Part of this rental may be contributed by the Zamindar.

(*f*) The Zamindar should never have the aim of trying to impose fine or compensation if he really desires any progress.

12. The District Board can help the society in the following ways :—

(*a*) By allowing the Veterinary Surgeon to visit the society once a fortnight. In order to facilitate the work, the village society should have the opportunity of approaching the Veterinary Surgeon direct without any reference to the headquarters of the Board and the Veterinary Surgeon should have the authority to visit any village without taking any previous permission from the Board's headquarters every time. Of course, he should always inform of such visits to the Board.

(*b*) The District Board should meet all the Testing Associ-

ation expenses of the Veterinary Surgeon and cost of medicines.

(c) As it stands at present, the Veterinary Surgeon has to come from Fatehabad. When the work of the society increases, a Veterinanry Surgeon at Bah may also be necessary. A small dispensary for emergency medical help can also be established in a central place for the societies.

(d) The Board may also allot a small sum of money to be given as prize to the calves of the members of the cow testing cocieties.

13. Help from Government can be obtained in the following ways :—

(a) From the Collector :—

(i) By making small remissions of land revenues of the land which has been specially set apart by the Zamindar for village Shamilat. This has to be revised from year to year.

(ii) By allowing the S. D. O. and the Tehsildar of the Tehsil to become members of Executive Committees of the Cow Testing Societies (combined with Cattle Breeding) and asking him to attend all the meetings of the societies. Though he may be a member of the Executive Committee, he should work in the advisory capacity rather than in executive capacity.

(iii) By recognising the help rendered by the S. D. O. and Tehsildar by letters of approbation.

(b) By the cattle Breeding Department :—

(i) By the supply of proper kind of bulls to the society.

(ii) By alloting a small sum of money for the feed of the bull and the expenses (initial) of the cow testing societies to carry on the experiment for a number of years.

(iii) By alloting a number of prizes for the best milk yielders and the best calves out of the bulls supplied by the Department.

(iv) By the visit of its departmental officers once a month and give necessary advice. It would be still better if the officer visiting the society is an expert in testing of fat contents of the milk (he shall have of course to bring down his own apparatus, etc., till the society is in a position to have its own equipment).

(v) By the supply of suitable literature on the subject so that suitable literature may be prepared for propaganda work amongst the villagers.

(vi) By contributing towards the salary of the supervisor appointed by the Co-operative Department.

(c) By the Veterinary Department:—

(i) By appointing a special officer in the locality who would be willing to look to all the questions of cattle diseases, the inocculation, etc., of the cattle belonging to the society.

(ii) By the supply of medicines free for a number of years to the society. It would be better if a small dispensary in the society is opened.

(d) By the Co-operative Department:—

(i) By lending the services of a supervisor without any cost to the society. It would be better if he is a holder of certificate in Agriculture from any of the Agricultural Schools in the province.

(ii) By allowing the Inspectors to work as executive officers of the societies. It would be better if a diplomate in agriculture is put in charge of this.

(iii) By taking up propaganda work.

14. *Financial obligation*:—As this undertaking would be an experimental measure, quite a large part of the financial obligation will fall on the Government at the initial stage. As no tangible results can be expected to come to any definite conclusion, a period of 5 years shall have to be allotted for the work. It is expected that if the experiment succeeds the societies would also begin to contribute towards some of the expenses such as the maintenance of the bull (its feeds, etc.), the costs of medicines, etc. Fortunately as the help is to come from several departments the burden would not be very heavy for one single department though the ultimate source of all the expenses would be the Government.

An estimate for income and expenditure is given below for the first and second years.

	Income.	*Yearly.* Rs.		*Expenditure.*	*Yearly.* Rs.
1.	Membership fee ..	.. 100	1.	Supervisor's pay and T. A. at Rs. 50 per month	.. 600
2.	Feeds that can be realised from the members for services ..	50	2.	Upkeep of 2 bulls for a year	150
3.	Fines, etc. ..	.. 25	3.	Prizes for the calves at 2 per calf..	. 100
4.	Contribution for prizes, etc., from the gentry	.. 20	4.	Prizes for milk records for 50 members ..	. 100
5.	Miscellaneous income	.. 5	5.	Recurring expenses for medicines, registers, etc.	.. 20
			6.	Payment of rent ..	.. 30
	Total	.. 200		Total	..1,000

From the above it will be seen that there would be a deficit of Rs. 800 per annum which has to be made good from other sources. In the above the price of the bull and Testing Association expenses of the Veterinary Surgeon, the Testing Association expenses of other departmental officers have not been included as this work would be part of their regular service. So, it is to make up this deficit that the help of Government and the District Board would be necessary.

I propose the following contributions by the different Departments :—

	Rs.	Rs.
1. Contributions by the Cattle Breeding Department :—		
(*i*) Upkeep of the bull	100	
(*ii*) Part payment of the salary of supervisor ..	250	
(*iii*) Prizes for the calves	100	
Total ..	450	450
2. Contribution by the District Board for prizes and medicines ..		100
3. Contribution by the Co-operative Department part payment of the pay of the supervisor for one year		300
4. Remissions of Land Revenue		30
Total ..		880

From this it will be noticed that there is margin of Rs. 80 which must be kept as such as no one can be sure of the miscellaneous income. As the work progresses, and the societies are on a sure footing, the expenditure would increase to at least Rs. 1,500. At that stage the Government may be required to contribute a little more but other sources of the income such as the service fee of the bull, the contribution by the ghee societies, imposition of ghee tax, etc., may also be explored and tapped and thus gradually diminish the Government contribution.

15. Some protective measures shall have to be taken, such as the executive powers of the Collector of the District may have to be exercised in such ways as for the weeding out of the scrub bulls and sending them away from the locality through the help of the Cattle Breeding Department, issuing prohibitionary orders on the keepers of the Scrub bulls to desist from using their bulls for breeding purposes, and those who have got bulls fit for breeding purposes should get themselves registered, etc.

Citronella oil, bane of mosquitoes, comes from a grass cultivated in Ceylon and Java.

FRUIT PRESERVES

By A. D. Chand.

Dry Date Preserve

Dry date	... 2 lbs.	Cardamon minor	... 1 oz.
Sugar	... 2 lbs.	Cinnamon	... 1 oz.

Process.—Wash the dates clean of dirt with cold water and boil them for about half an hour. When the dates become tender ladle them out carefully without breaking them and put them in a sieve for dripping.

Prepare a thin syrup of a given amount of sugar and transfer the prepared dry dates into it. When the syrup becomes viscous; strew over powdered cardamons minor and cinnamon and mix them thoroughly. Now remove the product from the fire and bottle it while hot.

This preserve is widely known and appreciated for its medicinal use in India. Two preserved dry dates a day will move the bowels regularly and in a month's time it will show its wonderful effect on the constitution and the general tone of the body. It is especially recommended for aged persons and for young children. The latter should be given a less number of preserved dates according to their age.

Blackberry Preserve

Blackberry	... 2 lbs.	Sugar	... lbs.
Salt	... 4 oz.		

Selection.—Almost all berries are naturally very tender and specially when they are over-ripe. It is necessary, therefore, to avoid over-ripe berries and to select ripe, but fairly hard ones. The reason for discarding over-ripe berries is that they are mashed up during the cooking process and produce an unsightly sort of preserve. Also discard all the injured, insect-eaten and mashed up berries.

Process.—Wash the blackberries with cold water; besmear them with finely powdered salt and leave them exposed to the sun for about five minutes. Have the hot water ready and wash off the salt from the berries with it. Draw off the water from the berries and also shake off the adhering water.

Now have a thin syrup of equal amounts of sugar and water ready and pour it over the berries. Place the container on the fire and apply a very slow heat until the consistency of the syrup reaches the consistency of honey. Remove it from the fire and

leave the preserve exposed to the air until it cools down. Then bottle the preserve and seal it airtight.

This preserve is very delicious. It is especially efficacious for persons, who are habitually suffering from constipation. It whets the appetite and is a very good medicine for all sorts of bowels' irregularities.

Beetroot Preserve

Beet	... 2 lbs.	Cardamon minor	... 1 oz.
Sugar	... 2 lbs.	Rose water	... 2 oz.

Both table and fodder varieties of beets can be used for making preserves, but the table variety is preferably used because it makes a more delicious and attractive preserve.

Process.—Select the beets; remove the fibres nicely and wash them. Make incisions all over the surface and soak them in cold water for an hour or so. Have the boiling water ready; introduce the beets into it and let them boil until the beets become a little tender. Remove them from the fire; pour them in a sieve for dripping and shake off all the adhering water. Now spread the beets singly, cool them and cut them into an inch cubes. The reason for boiling the beets with the skin is to retain their original colour. If the colour is not the desirable factor, the beets should be cleaned, washed, peeled, cut into cubes and then boiled; after making a few incisions on each piece.

Have a thin syrup ready; add to it the prepared beets and cook them over a very gentle and slow fire. When the syrup is fairly thickened, introduce powdered cardamon minor and rose water. Mix them thoroughly, remove the product from the fire and seal hermetically in wide mouth bottles.

This preserve keeps for a long time. It is a wholesome and nutritious diet, specially when taken early in the morning before taking anythig else.

The Fyzabad Training Centre Scheme:—We have just received a copy of the above scheme from the Director of Agriculture, U. P., according to which, young men of the agricultural classes will be given practical training in farming on a 100 acres of land for a period of three years. We heartily recommend the scheme to former students of agriculture who may not now be employed and would advise them to correspond directly with the Director of Agriculture, U. P., for more detailed information about the scheme.

RURAL RE CONSTRUCTION THROUGH PRODUCTION AND MARKETING OF WHEAT IN INDIA

By C. I. Kovoor, B.Sc.

(*Agriculture and Rural Economics*)

Printed by M. Y. Taib, Simla.

This is a book of forty-five pages, well written and well printed on substantial paper. It would be better with a cloth board cover.

This is a book giving a brief history of the orgin and distribution of wheat throughout the world. Comparative figures are given for the different producing countries, both as to amount and quality and variety, also comparative costs of growing wheat in India and in the countries that use the latest up-to-date machinery. It takes up the question of methods of transport, internal communications, internal and export trade. There are useful charts and graphs and a good bibliography.

Anyone who wishes to get a great deal of useful information about wheat in a short space would do well to consult this book. It is especially valuable for students in Agricultural Colleges in India.

Sam Higginbottom.

(*Continued from page 238*)

4. Both coli and aerogenes types are capable of growth in ice cream mix. If the coli test is used as an indicator of recontamination following pasteurization, growth of these bacteria may cause a misinterpretation of the results.

The same procedures used to insure a low count ice cream should enable the manufacture of an ice cream with a low coli count.

Various types of bacteria may grow in the dairy products used for preparing the mix, or in the mix itself. The following "off" flavours may be produced: sour, rancid, yeasty, bitter, cheesy, musty, unclean, putrid, fruity, and potato. Souring of the dairy products or the mix will occur at temperatures above 55 degrees F. as a rule. At temperatures of 50 degrees F. or lower, the various unusual "off" flavours which have been listed may develop. "Off" flavours due to bacteriological action may be prevented by pasteurization, low storage temperatures, and short periods of storage.

BACTERIOLOGICAL CONTROL OF ICE CREAM*

By W. B. Sarles, University of Wisconsin.

Three important considerations in the bacteriological control of ice cream are (1) prevent spread of disease-producing bacteria through ice cream; (2) how to meet certain standards used by health departments and other agencies in the bacteriological control of ice cream; (3) prevent growth of bacteria causing "off" flavours in ice cream.

Preventing Spread of Bacteria.

Ice cream is second in importance to milk among dairy products in causing the spread of disease. There are two types of diseases which may be spread through ice cream. One group consists of animal diseases, such as bovine tuberculosis, certain types of mastitis and contagious abortion. Children are more susceptible to bovine tuberculosis than adults. Mastitis caused by streptococcus epidemicus results in these bacteria being present in the milk. In human beings these bacteria cause a disease known as septic sore throat. The bacteria which cause contagious abortion in cattle may cause undulant fever in human beings.

Another group of diseases affect only human beings. The bacteria which cause these diseases may be spread through ice cream when infected individuals contaminate it. These diseases are typhoid fever, scarlet fever, diphtheria and human tuberculosis. The spread by means of ice cream of the disease-producing bacteria of animal origin may be prevented by inspection of the animals, inspection of the milk and by thorough pasteurization. The spread by means of ice cream of disease-producing bacteria of human origin may be prevented by keeping cases of these diseases, and carriers of the disease-producing organisms from coming in contact with ice cream. The employees of every ice cream plant should be subjected to frequent medical examination. New employees should be carefully inspected before they are hired. Thorough pasteurization of the ice cream mix is the greatest safeguard against the spread of disease-producing bacteria Great care must be exercised in order to prevent contamination of the mix or finished product after it is pasteurized. Not only should the mix be protected against recontamination; it should be kept cold (below 45 degrees F.) in order to prevent growth during storage. Cold will not kill disease-producing bacteria when they are in ice cream. It is true that the majority die off rapidly in the hardening room, but experiments have shown that the bacteria causing typhoid fever may live as long as two and one-third

* [The above article as well as the article on the Food Value of Ice Cream in the last issue of the Farmer were borrowed from the Ice cream Review.]

years, and those causing tuberculosis as long as three years, in ice cream kept at near O degree F.

How to Meet Standards.

The most common bacteriological standard for ice cream is the total count. This varies with the laws of different cities and states, but most limits approximate 100,000 to 200,000 bacteria per c. c. of ice cream. A low count ice cream indicates that high quality products were used, that these were properly pasteurized, and that recontamination and growth following pasteurization were largely prevented. The chances for disease-producing bacteria being present in low count ice cream are relatively slight. A high count in ice cream may indicate one or more several things. The large number of bacteria may be due to poor products going into the mix, to improper pasteurization, to recontamination following pasteurization, or to growth. High count ice cream is not necessarily more dangerous than low count ice cream, but the chances for disease-producing bacteria to be present are obviously greater. Here again pasteurization is of paramount importance in producing a high quality product. The chief sources of recontamination following pasteurization are the homogenizer, pipe lines and the freezer. All equipment must be cleaned and sterilized thoroughly.

Another bacteriological standard for ice cream is the test for Escherichia coli. In water this organism is used as an indicator of sewage pollution. If it is present there is a chance for the typhoid bacillus to be present also. In ice cream, the so-called coli test has been used for two purposes. It has been used to judge the effectiveness of pasteurization, and secondly, to check upon recontamination following pasteurization. The use of the coli test for ice cream may be criticized on the following grounds :

1. Escherichia coli does not have the same significance in ice cream as it has in water. It is almost always present in raw milk, and it may grow in the milk. It is mainly of animal orgin in milk.

2. As the test is commonly performed, it is impossible to tell whether the coli type or the aerogenes type is being tested for. This is significant because the aerogenes type comes mainly from the soil, from grains, and from the surfaces of plants. It is of no possible sanitary importance in ice cream.

3. Experimental work has shown that some varieties of Excherichia coli may survive pasteurization exposures in ice cream mix. Hence, it cannot be used as a test for the effectiveness of pasteurization until the question of its heat resistance is cleared up.

(*Continued on page 236*)

KEEPING MILK GOATS IN INDIA

By J. L. Goheen, B.A.

Chapter III

Feeding

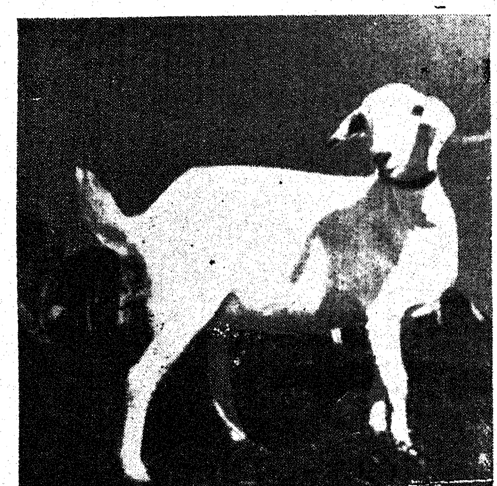
In an agricultural country like India the subject of feeding milk goats need not be a very difficult one. Any one who observes can see that goats eat a great many different kinds of green leaves ; also pods from bushes and trees ; such as the pods of the Babul (Acacia Arabica) ; grass and fodder ; and different kinds of grains or seeds. Occasionally they will even nibble at paper, cloth and such articles, but unless they are exceedingly hungry, due to neglect in feeding, they will not touch dirty things. Even human beings, when on the verge of starvation, have been known to eat objectionable things. It has been stated above that goats are very cleanly in their eating habits, not even touching articles that have been left by or trampled upon by cattle. They can tell by their sense of smell very easily about that.

Because of their cleanly habits not so many disease germs are likely to be found in their blood or digestive systems. This is a very important fact. Give them good, clean, nourishing food and they will be very likely to keep good health. Their drinking water should also be very fresh and clean, available when they want it. In the hot weather it should be kept in the shade in a cool place so that they may be refreshed by it. It is well to remember that, without plenty of water, a goodly supply of milk is not possible, nor will good health be maintained But let the water be clean, for filthy water is always a source of danger because of the germs it may contain. Cleanliness then, in both their feed and drink, is most important.

Another point to keep in mind is that different kinds of foods have different properties. And the body needs many different kinds of foods because it has so many different kinds of duties to perform. So, without a proper supply of different kinds of foods the body cannot be expected to perform all of its duties in the most efficient manner. The production of milk requires that different kinds of foods be eaten in sufficient proportions, because milk has in it a number of different properties. If a milk goat had only dry grass to eat it could not manufacture much milk, but if it also had green leaves and certain kinds of grains, plus a sufficient amount of drinking water, it ought to produce much more milk. It must have enough food in the right proportions to maintain its own strength and then have enough with which to manufacture milk.

The feeding of green leaves or green grass of some sort is always an important item in the daily ration of the goats. The succulent juices of the leaves and small stems help to maintain a good milk supply, and the fact that goats eat such leaves in the hot weather, when perhaps green grass is not available for cattle, means that they are likely to have more milk proportionately to cattle at that time of year, as well as butter milk. If goats are allowed to browse around in waste hilly land they will doubtless be able to eat many such leaves. If not, such leaves as those of the Babul or Banyan trees, or of the Shevari (Sesbania Aegyptiaca) plant, should be brought and hung before them.

Then too, they might have dry grass or finely cut-up pieces of fodder, and also there should be some grains, or by-products of grains, such as chaff or hulls, wheat bran or husks, or the broken kernels of horse gram, given to them morning and evening. A mixture of wheat bran and such cereal as *bazri*, or instead of *bazri* some other cereal like *jowari*, in the proportions of half and half by weight, has been fed to good advantage morning and evening at Sangli. Each goat has its own small box or container for holding the mixture and it is put before them at milking time when they eat it very happily. The amount for any one animal varies with the amount of milk she gives, her age and size, but roughly each one gets about half a pound of the mixture at a time.


Young Surti Doe soon to have first kid.

When the pods of the *babhul* trees are available they may be fed in these same containers morning and evening, and the amount of other grain feed may be cut down somewhat. In like manner the leaves and stalks of dried groundnut vines, may be fed in the containers and a good deal of the grain feed can thus be saved because these leaves and stalks, or those of similar varieties of plants of the Legumes, are very nourishing. The grains, or by-products of grains, are called concentrates while the other coarser feeds are called roughage. And as has already been stated, goats should have feeds of both classes every day.

The use of the boxes or containers mentioned above is important. The reason is that sheep and goats are subject to attack from small worms, "stomach worms." Other worms that live in

the intestines are also likely to be found inside the goats. All these are thieves or "parasites", because they live upon the food that the goat has eaten and which now is being digested. If goats have not been fed according to sanitary methods it is almost certain that such worms will be found inside them, because the worms themselves, or their eggs, stick to foodstuffs that have been thrown on the ground; the small worms, and especially their eggs, are not at all likely to be seen, but they are very prevalent in India and are one of the very worst enemies that goats have to contend with. By keeping the food boxes or containers always clean and by using them faithfully for all feeding, one can avoid having one's goats become contaminated with such worms. The ordinary iron basin makes a good container for such feed.

All green feed or roughage should either be tied into a tight bundle and hung up before the goat, or else there should be constructed a special manger into which such feed can be thrown. This must be so made that the goat cannot possibly get into it herself or into any way spoil the feed with her droppings. Such a manger can very easily be made of split bamboo, the point being to so construct it as to allow an opening large enough only for the head of the animal so that she may reach in and get her mouth to the roughage. All left-over green feed that has become wilted should be removed from this manger and it is important to keep it clean also, for it may become the hiding place for vermin and other undesirable creatures. Remember that an ounce of prevention regarding all these enemies is worth many pounds of cure because it is exceedingly difficult to remove worms from a goat that has once become infested with them. They multiply very rapidly in the body of the animal and often cause the goat to become so thin and weak that she is scarcely able to stand, let alone give any milk.

Goats ought to have salt to lick for they require mineral salts in their body in the same way that human beings require such salts. The lumps of rocksalt that can be bought in many bazaars are just the thing for them. These lumps of salt, of fairly good size, should be kept hung up in some suitable place where the goats can easily get at them, or else they may be kept in the manger. One can be assured that the goats will lick them with much satisfaction. The salt often helps to tone up the system and may even have some effect in removing worms from the body. Therefore it is the part of wisdom to supply these lumps of salt and keep them always where the goats can readily get at them. Ordinary small crystals of bazaar salt should not be given, for they cannot be licked so easily, and hence there is danger of too much being consumed by the goat at any given time, and that may cause much trouble.

There are a few other points about feeding that should be kept

in mind. First, no wet grass, fodder, or leaves, should be fed when in that wet condition. Such leaves or grass should always be put out in the sun to dry off, and then placed before the goats. Next, in the beginning of the monsoon, when the fresh new grass is sprouting, one should be very careful about allowing goats to eat the grass. Small quantities may be eaten at intervals but if too much be eaten at any one time, there is much danger that it will cause swelling. Therefore one must be very careful about this feeding of new green grass.

Finally, there should be regularity in feeding. The digestive system becomes accustomed to carrying on its work at regular times, just as human beings like their periods of rest. One should feed regularly at least three times a day—morning, noon and evening. And only enough should be given at any one time so that the goats may eat all up in half an hour or so. Thus, wastage of feed will be avoided and expenses can be kept down, and the goats will know when to expect their meals, eating with a relish that which is put before them. Regularity, then, is an important point always to be kept in mind.

Summarizing what has been stated above on the subject of feeding the following points have been brought out:

1. In a tropical agricultural country like India, with so many different kinds of feeds available, one should not have a difficult time feeding one's goats.

2. Cleanliness in feed and drink, however, is a very important matter and should never be neglected.

3. The feeding of a variety of feeds is an important point, because, different feeds have different properties, and the body has many different needs to be supplied, while the production of milk requires many different substances. Therefore, considerable coarse feed or roughage is required, while grains or their by-products, called concentrates, are needed in lesser quantity.

4. It is always advisable to furnish green leaves or green grass each day for such succulent juicy articles help to develop a good supply of milk, and also keep the body in healthy condition.

5. Boxes or containers for grain feeds, or concentrates, are very necessary, while there should be a manger into which all coarse feed or roughage should be placed.

6. Goats require salt and one of the best means of furnishing that is through the lumps of rock salt that may be secured in a great many of the bazaars.

7. Leaves or grass in wet condition should not be fed to goats. All should be dried off first before feeding. Likewise, in the early

(Continued on Page 244.)

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

August, 1934

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction.	Remarks.
1	92	76	84·0	83	29·44	0.24	11·07	E.N.E.	Ploughing for and sowing *bajra*.
2	92	76	84·0	82	29·34	0·03	11·10	E.	Weeding of *juar*.
3	95	78	86·5	83	29·28	..	,,	E.N.E.	,,
4	95	79	87·0	82	29·25	..	,,	E.N.E.	,,
5	95	76	85·5	94	29·26	..	,,	N.	
6	87	76	81·5	98	29·22	1·24	12·34	E.	
7	87	74	81·5	92	29·28	0·10	12·44	S.W.	
8	90	75	82·5	90	29·28	0·10	12·54	S.W.	Weeding of paddy.
9	88	76	82·0	89	29·24	0·08	12·62	Calm.	
10	90	76	83·0	85	29·26	0·02	12·64	E.	
11	92	75	83·5	96	29·23	0·56	13·20	E.	
12	92	76	84·0	85	29·24	0·04	13·24	E.	Grass cutting.
13	94	77	84·5	80	29·28	..	,,	E.S.E.	,,
14	95	78	86·5	75	29·31	..	,,	E.N.E.	,,
15	97	80	88·5	76	29·34	..	,,	E.	,,
16	99	81	90·0	70	29·32	..	,,	E.N.E.	Harvesting maize.
17	100	80	90·0	83	29·28	..	,,	N.N.E	,,
18	88	76	82·0	94	29·18	0·75	13·99	E.N.E.	Ploughing in sunnhemp for green manure.
19	84	74	79·0	90	29·16	0·37	14·36	E.S.E.	
20	90	75	82·5	91	29·26	0·10	14·46	S.E.	,,
21	86	72	79·0	99	29·26	2·46	16·92	W.	,,
22	86	72	79·0	90	29·24	0·02	16·94	W.N.W.	,,
23	88	73	80·5	91	29·21	0·99	17·93	N.N.W.	
24	85	72	77·5	93	29·18	0·17	18·10	S.E.	
25	83	70	76·5	82	29·40	0·11	18·21	W.S.E.	
26	88	73	80·5	80	29·42	..	,,	W.	
27	90	75	82·5	79	29·44	..	,,	Calm.	The Jumna reached the highest flood level this year
28	92	75	83·5	76	29·46	..	,,	W.S.W.	
29	94	74	84·0	88	29·46	0·56	18·77	N.N.W	Preparing for *rabi* crops.
30	87	75	81·0	89	29·48	Trace	,,	N E.	
31	91	74	82·5	92	29·44	0·24	19·01	W.S.W.	

September, 1934

Date.	Max. Temp.	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction.	Remarks.
1	89	73	80·0	90·0	29·40	0·53	19·54	W.	Preparing for *rabi* crops, cutting grasses, weeding *bajra* fields.
2	88	73	80·5	90·0	29·40	0·01	19·55	N.N.W.	
3	92	73	82·5	91·0	29·44	0·32	19·87	E.	
4	87	75	81·0	89·0	29·46	0·62	20·49	Calm.	
5	93	75	84·0	81·0	29·46	..	,,	E.	,,
6	96	79	87·5	74·0	29·39	..	,,	N.	,,
7	96	76	86·0	84·0	29·36	0·41	29·90	E.N.E.	
8	90	76	83·0	75·0	29·32	0·07	20·97	E.	
9	92	76	84·0	81·0	29·26	0·04	21·01	E.	

SEPTEMBER, 1934—(*Concld.*)

Date.	Max. Temp	Min. Temp	Mean Temp.	Percentage of Humidity.	Atmosphere pressure	Rain for the day.	Rain since Jan. 1.	Wind direction.	Remarks.
10	87	72	79·5	99·0	29·29	3·33	24·34	Calm.	
11	81	72	76·5	86·0	29·34	0·40	24·74	N.	
12	88	74	81·0	88·0	29·37	0·03	24·77	E.	
13	89	77	83·0	89·0	29·37	0·01	24·78	E.S.E	
14	90	76	83·0	93·0	29·30	..	,,	W.	Beginning sowing of vegetable seeds for winter.
15	90	75	82·5	80·0	29·34	Trace	,,	W.	
16	92	74	83·0	75·0	29·41		,,	W.	
17	91	74	82·5	74·0	29·42	..	,,	W.S.W.	Beginning of harvesting *juar* and *bajra* for fodder.
18	91	74	82·5	85·0	29·39		,,	W.S.W.	
19	84	74	79·0	74·0	29·34	0·15	24·93	W.	
20	92	74	83·0	75·0	29·41	.	,,	W.N.W.	
21	92	73	82·5	93·0	29·38	0·71	25·64	N.E.	
22	89	74	81·5	87·0	29·38	0·02	25·66	E.	
23	89	73	81·0	80·0	29·39		,,	E.	
24	90	74	82·0	76·0	29·39	..	,,	E.	
25	93	76	84·5	75·0	29·42	.	,,	E.N.E.	
26	90	71	80·5	93·0	29·48	1·92	27·58	Calm.	Beginning to harvest *banda*.
27	83	70	76·5	91·0	29·58	0·11	27·69	E.	
28	88	72	80·0	82·0	29·52	..	,,	E.	
29	92	76	84·0	83·0	29·48	..	,,	E.	
30	89	72	80·5	81·0	29·52	0·06	27·75	E.	

(*Continued from page 240*)

monsoon when the new grass is very fresh and tender, it is dangerous to permit goats to eat very much of it at any one time. In other words, it should be fed very sparingly.

8. Regularity in feeding is a most important point. There should be about three set times a day for feeding, and only enough should be given at any one time as may be eaten in half an hour or so.

SPECIAL NOTES.

1. The general opinion that anything is good enough for a goat is a mistake. Goats will do best on good food and one should make a study of this business of feeding them, so that they may keep well and strong and furnish a good supply of milk.

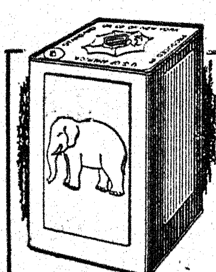
2. A warning should be issued against the use of stunted and and immature *jowari* (Kafir corn) fodder in green condition. It is likely to have in its juices a strong poison, while in that condition and the eating of such fodder will prove to be injurious to the goats.

Protect your tractors and machines with *correct* lubrication

AGRICULTURAL machinery is a heavy investment, well worth protecting. Operating costs *must* be kept low, but experienced tractor-owners know it is very false economy to use any but the best oils and greases. It may appear possible to save a few annas by buying a cheaper oil, but far more is lost by the resulting rapid wear and need for frequent decarbonisation, repairs and replacements.

The only true economy is to keep tractors and other machinery always in good condition by *correct* lubrication. There is a scientifically correct grade of Mobiloil for every make of tractor, and oils and greases for all other machinery. Consult the Mobiloil Chart, follow its recommendations, and you are sure of keeping all your machines in the best working order at the lowest overall cost.

Always use **Mobiloil**



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